SCIENTIFIC AMERICAN

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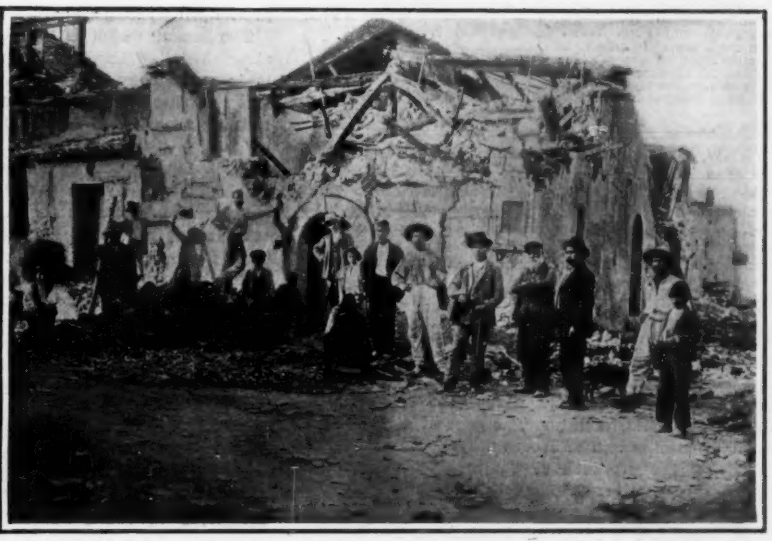
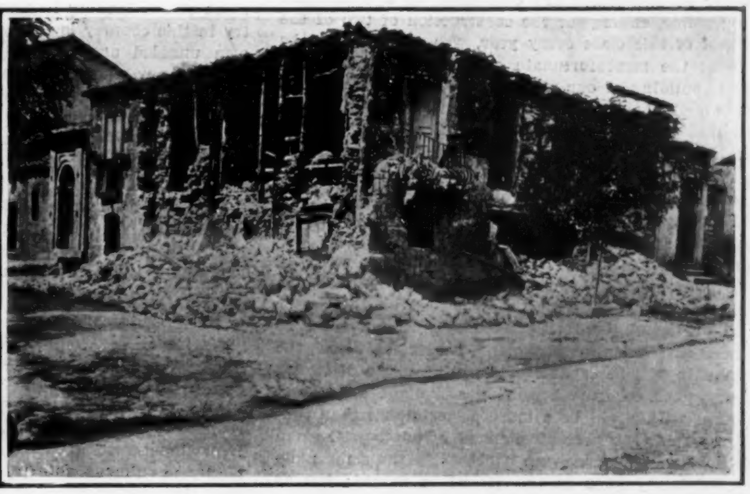
English sailors aiding in rescue work.



A typical scene in ruined Calabria.

Searching the ruins of Palmi.



The ruins of a typical frail Calabrian house.

A ruined house near Bagnara.

Soldiers razing walls in danger of falling.

THE ITALIAN EARTHQUAKE.—[See page 82.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, JANUARY 23, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE NAVAL PROGRAMME FOR 1909.

The programme of the Navy Department, which received the indorsement of the President, calls for the expenditure of $75,000,000 in the construction of thirty new ships, including four first-class battleships, or double the number of battleships that Congress was disposed to build, each year, as part of a continuous naval programme. The House Naval Committee has cut down the proposed expenditure by nearly two-thirds, to a total of $29,000,000; and the increase of the navy, as now proposed, will include fifteen new ships, namely, two 26,000-ton battleships, five torpedo-boat destroyers, four submarine boats, one sub-surface torpedo boat, and three colliers.

The disposition of the last Congress to commit itself, as far as battleships are concerned, to a continuous programme, calling for the construction of two of the largest of this class every year, was considered to be one of the most fortunate events in the history of the upbuilding of our modern navy. If it be adhered to, we shall have no difficulty in maintaining our position as the second most powerful navy in the world; and it would certainly seem to be wiser to encourage Congress in holding to a continuous programme of this character, rather than go back to the old haphazard methods of earlier years. The two battleships will be the largest ever laid down by several thousand tons. Their displacement will be 26,000 tons; and they will carry twelve 12-inch, 50-caliber guns in six turrets, all placed on the center line of the ship. If the middle pair of turrets be placed *en echelon*, or diagonally, across the vessel, the new ship will be capable of directing a fire of twelve heavy guns on each broadside and eight ahead and astern. This will be a more powerful fire than that of any ship at present planned. The new German battleships, it is true, can concentrate the same number of heavy guns in the directions named; but as these are 11-inch pieces, of less caliber-length, their fire will be of far less power than that of the proposed battleships.

We have one fault to find with the Senate recommendation, and that is that the provision for three colliers is altogether too scanty. So serious do we consider the lack of colliers in the crippling effect which it would have upon our naval operations, that we would prefer to see the torpedo boats and submarines cut out altogether, and the balance of the appropriation, after providing for the two battleships, devoted to the immediate construction of eight or nine colliers, of the new "Vestal" and "Prometheus" type, each of which can carry 6,000 tons of coal at a sea speed of 16 knots an hour.

OUR DECADENT MERCHANT MARINE.

The signs of the steady decadence of our merchant marine are written so clearly, that he who runs may read. Those of us who a few years ago were hopeful that an era of rapid upbuilding had begun, and that the United States was in a fair way to win back something of that prestige which was hers before the ravages of the civil war swept our magnificent fleet of sailing ships from the high seas, must view with regret, even if it was not unexpected, the abandonment of the Eastern Shipyard at New London, in which Mr. James J. Hill, by the construction of the then two largest steamers in the world, endeavored to establish a strong hold on the Oriental trade, and incidentally assist in winning back for our merchant marine something of its one-time prestige.

In those days Mr. Hill firmly believed that American ships, built in American yards, and embodying the many well-known advantages which accrue to a freight steamer of the largest size, could be run profitably without any assistance from the government; and we may be satisfied that the conduct of the new venture was marked by those excellent business methods, which have rendered the transcontinental road with which the steamships were associated such a conspicuous success.

One of these fine vessels was lost off the coast of Japan, it is true; but it is also true that the vessel was insured, and hence the failure of Mr. Hill to take any steps toward replacing the ship must be regarded as highly significant. Although the sister ship "Minnesota" is still running in the Pacific trade, the fact that she is generally understood to be for sale, coupled with the recent dismantling and abandonment of the yards where she was built, must be taken as a tacit acknowledgment of the failure of an enterprise upon which so many high hopes were centered.

The lesson which is written so clearly upon this abandoned New England shipyard is not new. Rather it is one among many accumulating proofs of the fact that, because of the greater cost of building and running American ships, it is hopeless for this country to try to establish a merchant marine in the face of keen foreign competition, unless some measure of aid be afforded by the government.

In seeking for government aid, the shipping interests do not ask that any new policy be established. They simply request that the principle of protecting young industries, until they have developed to a point at which they are able to meet foreign competition unaided, be extended to the merchant marine. It is confidently believed that if government aid were extended in some form or other, preferably as compensation for carrying the mails, the resulting increase in the shipbuilding business would be so great, as ultimately to place the shipping industry in a position to meet foreign competition unaided. When that stage of development approaches the subsidies could be gradually reduced, and finally withdrawn. Expectations of the successful working of a system of this kind are strongly warranted by the phenomenal development, during the past two decades, of some of our leading industries, and notably that concerned in the manufacture of steel. The recent statement of our leading ironmaster, that the steel industry in this country is to-day strong enough to hold its own unaided against free European competition, is fresh in our minds; and we confidently believe that the extension of a well-considered measure of government aid to our merchant marine would, in the course of time, enable this country to win back something of its former proud position as the leading maritime nation of the world.

Postmaster-General Meyer, speaking of the ocean mail service, says that with the exception of our service to Jamaica, Cuba, and the Atlantic ports of Mexico, which has prospered under the act of March 3, 1891, our mails to Central and South America, West Indies, Australia, and the Orient, are almost wholly dependent on foreign steamers, over which we have no jurisdiction. He further notes that within two years the number of American steamers crossing the Pacific and available for carrying the mails has been reduced more than one-half. Last year, the Post Office Department recommended, and the Senate by a practically unanimous vote passed, a bill which provides that the compensation of $4 a mile, now allowed to 20-knot transatlantic American mail steamers, be allowed also to American steamers of not less than 16 knots speed on routes of 4,000 miles or more to South America, the Philippines, Japan, China, and Australasia. It would require several years to establish the new mail routes which are contemplated in the bill, since most of the fast steamers would have to be built. The passage of the bill would impose no large immediate expenditure; whereas the creation of new mail lines would promote trade, stimulate shipbuilding, and greatly strengthen the auxiliary naval forces of the government.

THE TRAFFIC OF A GREAT CITY.

Not many of us were prepared for the really stupendous figures of the passenger traffic of New York city, which are made public in the report, for 1908, of that most admirable and efficient body known as the Public Service Commission. It appears that the surface, elevated, and subway companies in New York carry annually over 1,300,000,000 passengers. What these figures mean will be better understood, when it is stated that they are over 66 per cent greater than the total number of passengers carried in the same year on all the steam railroads of the country combined. The total capitalization of these transportation companies is over $533,000,000, and they derive annually from the passengers carried over $62,000,000. Incidentally, it may be mentioned that the capitalization of New York's gas and electric companies is over $386,000,000, and that they sell, annually, 32,000,000,000 cubic feet of gas; which amount is more than twenty per cent of the entire gas production in the United States. Moreover, the income from the sale of electricity alone in the city exceeds $20,000,000.

By the close of 1908 the city had expended over $50,000,000 in the construction of subways; and an additional $100,000,000 will be necessary to build the Broadway-Lexington Avenue line, the loop lines connecting the Williamsburg and Manhattan bridges, the line across Manhattan below Canal Street in Manhattan, and the Fourth Avenue line in Brooklyn.

So much confusion exists in the public mind as to the exact status of the proposed new construction, that the following information from the report will be of no little interest. In the first place, the Commission declined the proposal of the Interborough Company to build a road by way of the new Manhattan Bridge from Flatbush Avenue, Brooklyn, to the Third Avenue Elevated Road in Manhattan, preferring instead to proceed with the construction of the Fourth Avenue Subway in Brooklyn. The construction of this line, however, has been held up by a taxpayer's injunction, and the matter is still in the courts. The Broadway-Lexington Avenue Subway has been delayed by the difficulty experienced in getting the consent of property owners. A decision of the Appellate Division rendered last month has cleared the way for the Board to proceed with the construction, and it hopes shortly to adopt the final plan of its chief engineer. Plans are also being prepared for a subway to run below Canal Street, from the Manhattan Bridge to the Hudson River, with provision for a rail connection at the intersection at Broadway with the proposed Broadway-Lexington Avenue line. The Subway loop connecting the Williamsburg and Brooklyn bridges is being pushed to completion, except on that section which passes below the new Municipal Building adjoining the Brooklyn Bridge Terminal, where it will be necessary to lay the building foundations before completing the Subway. The refusal of the Utilities Board to purchase the Steinway tunnel from the Interborough Company was due to the objection, among many others, that the contract for operation proposed by the Interborough would have cost the city some $350,000 a year.

The suggested improvements in the operation of the existing subways, made by Bion J. Arnold, are being followed in two particulars. First, with a view to facilitating the loading and unloading of trains, several new cars are under construction, which will be provided with a pair of doors at each end of the car, one of each pair being for ingress and the other for egress; and it is expected that some of these cars will shortly be placed in operation. Unless some unforeseen difficulties develop, it seems to us that the new cars should result in a considerable acceleration of the train service, due to the cutting down of the time of stops at stations. The new signal system proposed by Arnold, which permits express trains to be run under shorter headway, has proved so successful at the greatly congested 96th Street station, that the company is planning to install it throughout the line. Another important improvement is the alteration of the Bowling Green station to permit of a service of shuttle trains between Bowling Green and South Ferry, with a view to allowing all express trains to be run through to Brooklyn.

Most commendable has been the work of the Commission in gathering careful statistics of accidents and fatalities on all transportation lines. The total number of accidents has reached during the year the appalling total of 50,000, in which no less than 600 lives have been lost. Impelled by these statistics, the Commission conducted a series of extensive competitive tests of fenders and wheel guards, which were thrown open to all manufacturers in this country and abroad. We sincerely hope that these tests will shortly result in the enforced adoption of some satisfactory life and limb saving device on all the street railways of this city.

◆

Sir James Dewar having succeeded, by the use of the radiometer, in detecting a gas pressure of the fifty-millionth of an atmosphere, and having definitely detected by this means the helium produced in a few hours from about ten milligrammes of radium bromide, has undertaken the direct measurement of the helium produced by radium. For this purpose he employed 70 milligrammes of radium bromide belonging to the Royal Society, which had been used by Dr. Thorpe in his recent determination of the atomic weight of radium. The apparatus employed for measuring the helium consisted of a McCleod gage in which no rubber joints were used, together with ingenious arrangements for exhausting the apparatus. Any traces of adventitious gases were absorbed by an attached bulb containing charcoal and cooled in liquid air. In one instance the pressure registered at the start of the experiment was 0.000044 milligramme. The radium salt was occasionally heated and the pressure of the helium was determined from time to time. A steadily maintained helium increment was obtained of approximately 0.37 cubic milligramme per gramme of radium per day. This result agrees very closely with Rutherford's theoretical calculation, which gives about 0.3 cubic millimeter per day.

ENGINEERING.

State Forest Commissioner Whipple estimates the forest fire losses in New York State alone, during the past year, at nearly $800,000. Of 700 fires reported, 90 are attributed to hunters, and nearly 400 to railroad locomotives. A total area of 177,476 acres was burned over, of which over 50,000 acres were State lands.

It is estimated that in the Borough of Manhattan there are about 10,000 passenger elevators and 12,000 elevators for freight service. In twenty-six office buildings of eighteen stories and over, with a rentable area of 116 acres, there are 231, elevators, which travel between 4,000 and 5,000 miles of vertical distance each day, and carry 615,000 passengers. There are 8,000 elevators in office buildings alone.

In the closing days of last year an actual start was made in the manufacture of steel at the new city of Gary, Ind., which has been built by the United States Steel Corporation on the shores of Lake Michigan, a few miles to the east of Chicago. This important step was signalized when blast furnace No. 12 was blown in. The mills embody the very latest practice in the art of steel making; and the estimated cost of the plant as projected is $25,000,000. If the plans of the company are carried out, Gary must become one of the greatest centers of the iron and steel industry in the world.

The New York, New Haven & Hartford Company have asked permission from the Public Service Commission to electrify the branch line of their system from New Rochelle to the Harlem River. This line has recently been equipped with six tracks; and it is believed that the proposal to electrify the road is part of a scheme on the part of the New Haven Company to obtain an independent line into New York city by way of the new bridge of the Connecting Railroad at Hell Gate, a line through Long Island City, and a tunnel beneath the East River.

Those naval specialists who are perturbed at the growth of what they are pleased to call the "speed mania," will be startled to learn that the latest battleship cruiser to be laid down for the British navy is designed for a contract speed of 28 knots. The sister ships were designed for 25 knots and made, on trial, from 27 to 28 knots. Therefore, it is not improbable that, in two or three years' time, we shall be confronted with the spectacle of an 18,000-ton warship that is able to transport her battery of eight 12-inch guns at a speed, for a short dash, of 30 knots and a sustained speed of over 27 knots.

The German auxiliary sailing ship "R. C. Rickmers," the largest sailing ship afloat, has proved that the days of the profitable square-rigger, if she only have an auxiliary to help her through the calms, are by no means over. During her two and a half years of active service, she has covered over 100,000 miles, and her earnings have been about $2.25 for every mile of that distance. This noble ship, 441 feet in length, formed the subject of a front-page illustration in our issue of October 6, 1906.

All the vessels of our battleship fleet are to be equipped with the new spiral latticework military mast of the kind illustrated in our issue of November 14, 1908. Before this work is commenced, the government intends to make a seagoing test, to determine how much vibration this type of mast will be subjected to under ordinary conditions at sea. The test will be carried out on the new battleships "Idaho" and "Mississippi," and will be in charge of Naval Constructor Robinson, who was chosen to accompany the Atlantic fleet on its cruise from Hampton Roads to San Francisco.

According to the United States consul at Chemnitz, the German government is offering prizes for an effective method of combating the destructive effects of factory gases upon vegetation. Damage to agriculture and to the extensive forests by the smoke of the numerous factories is becoming every year more marked. Hence the Saxon Ministry of Finance is offering a prize of $2,400 to the inventor who provides the best preventive of the injuries now due to sulphurous acid and other acid vapors in factory smoke, and to the effect of the harmful products of the combustion of bituminous coal. An additional prize of $500 will be given for the best compendium of the literature on the subject.

In spite of the serious depression of the past year, the figures for new railroad construction show that in 1908 there was built a total of 3,214 miles of new road. This is a considerable falling off from 1907, when 5,212 miles were constructed; but it is only 600 miles less than the total for 1904, and exceeds by over 100 per cent the figures for 1895, when only 1,428 miles of new road were constructed. The statistics of new car construction show that as compared with 1907, when over 284,000 freight cars were built, and 5,457 passenger cars, there is an enormous falling off, the totals for 1908 being respectively 76,555 freight and 1,716 passenger cars.

ELECTRICITY.

An international electrical exhibition will be held at Brescia, Italy. The exhibits will be divided into fourteen groups covering all classes of electrical application.

It is reported that the Pennsylvania Railroad, which is now investigating the results attained by the use of telephones on western railroads, is favorably impressed, and may adopt this system of train dispatching in place of the telegraph.

One of the latest electrical novelties for household use is the electrical razor. The form of the razor is similar to the well-known safety type; but the razor is given a vibratory movement by means of a rotary eccentric in the handle of the device. This motion is sufficient to cut the beard as the razor is drawn across the face.

A new material has recently been produced in the electric furnace to take the place of platinum in electric cooking and heating devices. The new product is called *silundum*, and is produced by subjecting carbon to the vapor of silicon. The result is a silicified carbon which is similar to silicon carbide and has many of the same properties. It resists temperatures of 1,600 deg. C. and does not oxidize, nor is it affected by acids. As a conductor of electricity its resistance is several times that of carbon.

A sensitive mono-telephone has been described by Henry Abraham before the French Academy of Science. In place of the ordinary diaphragm an armature of sheet iron is supported on two steel wires stretched tightly across the magnet of the telephone. The armature is of such size that it barely covers the magnet. The tone produced by the armature may be varied by adjusting the tension of the wire. The instrument is thus made as sensitive as the ordinary receiver, but is particularly sensitive to frequencies corresponding to the natural sound period of the armature. The instrument is particularly designed for use in wireless telegraphy on systems tuned to a certain wave length.

The town of St. Albans, near London, is using a novel system for generating electricity. The generating station which has just been completed uses no fuel except the town refuse. The refuse is burnt in a destructor plant capable of consuming from 50 to 60 tons per day of eighteen hours. The combustion chambers are provided with large furnace doors to permit of the introduction of large articles, such as mattresses, animal carcasses, and the like. The plant is equipped with two engines each operating two 75-kilowatt direct-current generators. The current is generated at 230 volts on either side of a 460-volt three-wire system. The battery room of the plant contains 268 cells with a capacity of over 1,000 ampere hours at a 10-hour discharge rate.

A novel single-truck electric car is being used on a small Pennsylvania road in which the monitor roof is eliminated, giving the car a very peculiar squat appearance. The advantages gained by eliminating the monitor roof are that more head-room is provided inside the car and the sashes of the windows may be raised much higher than usual. A special ventilating system is provided which does away with the ordinary ventilators of monitor roofs. The truck of the car is peculiar, in that it supports the car body at each end by means of bolsters. The bolsters are made up of heavy elliptical springs which do away with side sway and are stiff enough to prevent the car from lurching and lunging with every little irregularity in the track. The car is equipped with a hydraulic brake. The motorman applies the brake by oscillating a lever back and forth several times to pump water into the brake cylinders. The brakes are released by pressing the lever against a valve.

The following record of the energy of a sal-ammoniac battery has been sent us by the Rev. William F. Rigge, S. J., of Creighton University: Two ordinary sal-ammoniac cells operate an electric dial from a master clock. The cells are quart size. The carbons are cylindrical, with a zinc rod in the middle. Half a pint of loosely-packed powdered sal-ammoniac is supplied to each cell with as much water as the jar will hold. The circuit is closed one second every minute. Under these conditions it was found that the zincs lasted about a year, and the solution required renewal after an average period of two years and two months. The resistance of the dial magnet is 16 ohms, of the line 2 ohms, and of the battery 1 ohm. The electro-motive force of the two cells in series is 3 volts, thus furnishing 3/19 of an ampere. As the circuit was closed one second every minute, the battery was in operation for 24 minutes each day, and for 316 hours in the two years and two months. This would mean an active duration of 13 1/6 days, or nearly two weeks, if the current could be supplied continuously. The life of these sal-ammoniac cells was therefore $316 \times 3/19 =$ very nearly 50 ampere hours.

SCIENCE.

J. Bouma and S. Berend produce a sugar-free milk preparation according to a German patent by precipitating the casein with carbon dioxide in the presence of monosodium phosphate. This salt has an acid reaction, and the product is amphoteric in reaction. Hitherto by precipitation with carbon dioxide it was impossible to produce a neutral preparation; the product was invariably alkaline.

Genuine Jamaica rum can be distinguished from its imitations and all other spirits by means of the absolutely characteristic ingredient which is the chief source of its peculiar odor. This ingredient is not an ester, an aldehyde, or a ketone. It possesses the character of an essential oil and is probably related to the terpenes. Jamaica rum contains a second characteristic ingredient, which smells somewhat like turpentine, but this is less conspicuous than the first, by means of which the chemist can often detect even the adulteration of genuine Jamaica with imitation rum.

From experiments on dogs Faust had concluded that the comparative immunity against morphine which follows from its habitual use, is not due to the tissues becoming accustomed to the drug, but to an increasing capacity of the organism for destroying the poison. This view has recently been confirmed by Rübsamen, who showed that immune rats actually do break down the morphine in their system more rapidly than the normal rats. However, it appears that the immunity must be due to two causes: first, as stated above, to an increased capacity for destroying the poison in the system, and secondly, to a cellular immunity, for within the first hour after injection a large amount of the poison still circulates in the body, without affecting the individual.

The Carnegie Institution of Washington has awarded a contract for the construction of a craft for the magnetic survey. She is to be constructed without the use of iron or steel or any other magnetic metal. The purpose of the Institution is to make with her an accurate magnetic study of all the oceans. The propelling engines, machinery, and other parts of metal on the craft will be chiefly bronze. Manganese metal and gun metal will also be employed. Every bolt, nail, bar, and brace in the vessel will be of this material. All the machinery will be of bronze, and the anchors as well. There is some doubt as to whether the crank shaft of the engine can be constructed of bronze. The SCIENTIFIC AMERICAN hopes to publish an exhaustive account of this non-magnetic craft in the coming spring.

The astronomers of antiquity knew how to predict eclipses of the moon, which follow one another in regular succession and are visible at one time to all the inhabitants of one hemisphere. Solar eclipses also occur in regular order; in 223 lunar months there are in general 29 eclipses of the moon and 41 of the sun. But the latter are in each case visible only over a restricted portion of the globe, and their occurrence at any particular point is subject to somewhat complicated laws, with which the ancients were not familiar. From a study of eclipses which occurred in past ages, P. H. Cowell has reached the conclusion that the period of revolution of the earth, in other words the length of the year, has decreased within historical times. This result has been confirmed by Crommelin. The determination of the time of eclipses in the past is a valuable tool in historical research, in fixing the date of important events and epochs. Thus Mr. King has calculated that a total eclipse took place at Babylon in 1062 B. C. Another date thus fixed is October 6, 1241, on which Mr. Crommelin has shown that a total eclipse took place.

When the Japanese army evacuated Manchuria it became necessary to disinfect very rapidly a great number of garments, many of which were made of fur, while the troops were taking a bath preparatory to embarking on the transports, which were to convey them to Japan. The ordinary processes were rejected as too slow and the following expeditious method was substituted, with excellent results: The garments were hung, or placed on racks in rooms, into which steam at the pressure of six atmospheres was forced until the temperature rose to 100 deg. F. At the same time the air of the room was pumped out through an aperture near the floor, in order to produce a lively circulation of steam and a rapid saturation of the garments. After twenty minutes' steaming, a spray of formic aldehyde was thrown into the entering current of steam, and the steaming was continued for ten minutes longer. The walls of the disinfecting rooms were only six or seven feet high, and were so constructed as to minimize loss of heat by conduction. The capacities of the rooms ranged from 1,000 to 1,600 cubic feet. About one fluid ounce of the commercial 40 per cent formol solution was used for each 50 cubic feet of space, the solution being reduced to spray and vapor in about one minute. The efficacy of the process, even when applied to five layers of fabric piled together, was proved by numerous bacteriological tests.

THE SUBMARINE MINE.

BY GEORGE FORREST.

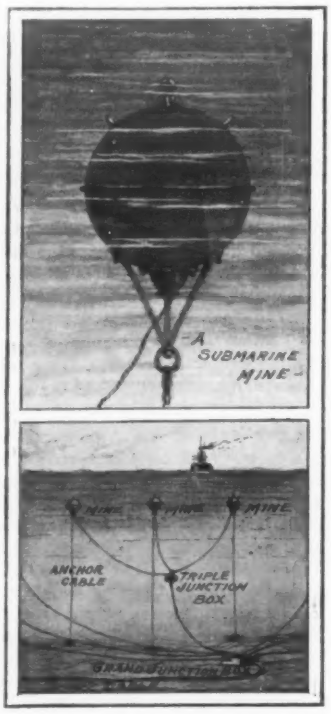
The first official recognition of torpedoes, or mines as they are now called, was in 1869, when Congress added submarine mining to the work of the Engineer Corps of the army. About 1871 Gen. Abbot commenced a series of experiments at Willets Point, N. Y., which led to the adoption of the system used to protect our harbors in 1898. There is little doubt that the knowledge of our waters being well mined had something to do with keeping Admiral Cervera from paying us a visit then, as our gun defenses were notoriously weak.

The mine is simply a hollow sphere of steel, 32 inches in diameter. At the top is a ring for handling, and at the bottom a detachable cap. In the interior of this cap a watertight joint is made, connecting the cable to the wire leading into the firing plug. The anchor most in use is one weighing 500 pounds, the connection being a wire mooring rope, which is cut 10 feet shorter than the distance from the bottom to the surface of the water at low tide. The charge consists of 100 pounds of dynamite No. 1.

Mines are now planted in what is known as "grand groups," which consist of twenty-one mines in groups of three. Some distance in the rear of the line of mines there lies on the bottom of the bay a grand junction box, from which seven cables spread, each leading to a triple junction box, which in turn controls its small group of three mines. From the grand junction box leads the multiple cable also, which winds its way to the switchboard connection in the operating room ashore.

The first movement in planting a grand group is to locate the position of the grand junction box. Observations are taken with the range instruments in the fire commander's tower. Then the exact range and position of the mine field having been determined, two men with signal flags are stationed on opposite shores. A small boat is now sent out with a light anchor attached to a buoy. The progress of this boat is directed by the flags, and at the proper signal the lashings are cut, and the anchor drops to the bottom. We now have a buoy on the surface of the water, which marks temporarily the position of the grand junction box.

While this work is going on, the powerful steel tug known as the mine planter has been held in readiness near the shore.. It now steams over to the marking buoy, and replaces the light anchor with one weighing 500 pounds. Here a small boat is moored, and the end of a measuring line is passed to the man in charge. Quickly the planter steams straightaway to the front, and at 100 feet drops another anchor. This is the position of the first triple junction box, directly under the line of mines. There are seven of these triple junction boxes to plant, 300 feet apart and directly across the channel. The small boat now moves over to this last anchor, and takes the end of another measuring line from the planter. This line has a red mark every 280 feet, and a black one every 300 feet. The planter steams straight to the left, paying out the line as she goes, and as the warning mark—red—passes, the officer in charge commands "Prepare to trip." At the word "trip" the anchor with attached buoy is dropped overboard, and thus the position of the second triple junction box is marked on the surface of the water. Continuing the work, we have indicated by buoys the position of the seven triple junction boxes, in the center of which, 100 feet in the rear, is the grand junction box.



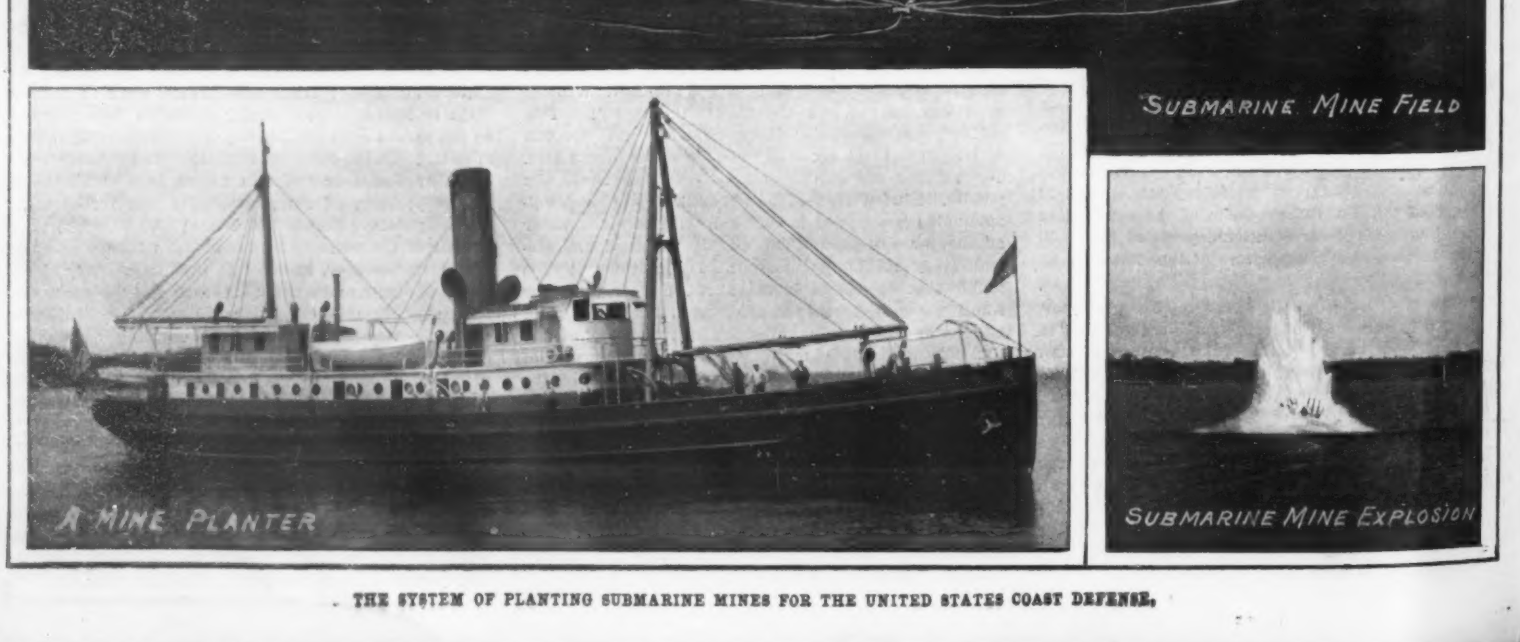
This mine is a hollow steel sphere 32 inches in diameter containing 100 pounds of dynamite. It is detonated electrically or on contact with a ship.

Submarine mine and details of wiring.

We are now ready for our cables, which are of two kinds, single, and multiple or seven core. This core, which is of copper, is covered with a layer of rubber tape, then two wrappings of jute, and finally an armor of steel wires. The first to be laid is the multiple cable, connecting the grand junction box with the operating room ashore. We already have a small boat out containing the grand junction box at its marking buoy. From the dock the planter takes the reel of multiple cable aboard, and fastens it to a specially constructed hydraulic jack. A rope is passed ashore through a block fastened to any convenient tree and back to the windlass. By hauling on this rope, the end of the cable is pulled ashore and fastened. Proceeding to the small boat containing the grand junction box, the planter pays out the cable as it goes. Upon arriving, the cable is cut and handed over to the men in the small boat, who proceed to make of the end a "Turk's head." This Turk's head is constructed by slipping over the end of the cable an iron snug-fitting ring or collar. The armor wires are then bent back over this collar about 15 inches. Lashings of heavy twine are used to hold these wires in place. This allows about 15 inches of the core to project for connections inside the grand junction box. The men now place the end of the cable in its proper socket in the box. It is then clamped down just behind the collar by screwing home the bolts. This prevents any possibility of the cable being twisted out of its socket by the heavy currents and constant wave movement of the buoyant mine. Later, when the seven triple junction box cables are each arranged in their proper sockets, and the watertight connections are all made with the multiple cable inside the box, the waterproof compound is poured over all; the cover bolted down, and all is ready for dropping the box overboard.

But we have not come to that yet, as there is plenty of work still to be done. Returning to the dock, the planter takes aboard the branch cables used for connecting the triple junction boxes with the grand junction box. They are coiled in a large figure eight, tagged with their proper number, and placed conveniently on deck. These cables are numbered, because, as will be seen by referring to the sketch, they are necessarily of different lengths. Steaming swiftly to the anchored open boats, the end of a cable is first passed to the men in the grand junction box boat. Then moving over to the triple junction box boat, the planter's crew hands out the other end. The crews in both small boats are now very busy making Turk's heads, placing them in proper sockets, and making inside box connections as above described. Repeating this work, we have the entire grand group of seven triple junction boxes connected with the grand junction box.

While all this work is going on, another detachment ashore has been loading the mines, cutting the mine cables, and preparing all for planting. All being ready, the twenty-one mines are placed on board the planter. While it is steaming out to the mine field, the men arrange the cables along the decks and hang a mine with its cable and anchor on each side of the boat. Once again a Turk's head end of a cable is passed to the men in the small triple junction box boat, but this time it is the *mine* cable. Again connections are made with the triple junction box as described. The mine end of the cable has already been connected in the mine



THE SYSTEM OF PLANTING SUBMARINE MINES FOR THE UNITED STATES COAST DEFENSE.

before loading on board the planter. Quickly the men in the small boat make their connections. Meanwhile the planter backs slowly away and drops the mine. The work so continues until the third mine of each group of three is dropped overboard. Then at a signal from the planter, the men in the small boat containing the triple junction box drop the box overboard. We have now planted one of the small groups of three mines with its triple junction box. After all have been so planted the signal is given, a last rigid inspection is taken, and overboard goes the grand junction box. It only remains to collect all buoys, and the grand group is ready for the enemy's fleet.

By an ingenious arrangement, one mine, three mines, or the whole grand group can be fired at once, either from the operating room ashore or by contact with a ship, all at the will of the operator. For quick execution, reliability, and absolute destructive power, we do not believe the equal of the American submarine mine exists in the world.

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AEROPLANES AND MOTORS AT THE FIRST PARIS AERONAUTICAL SALON.

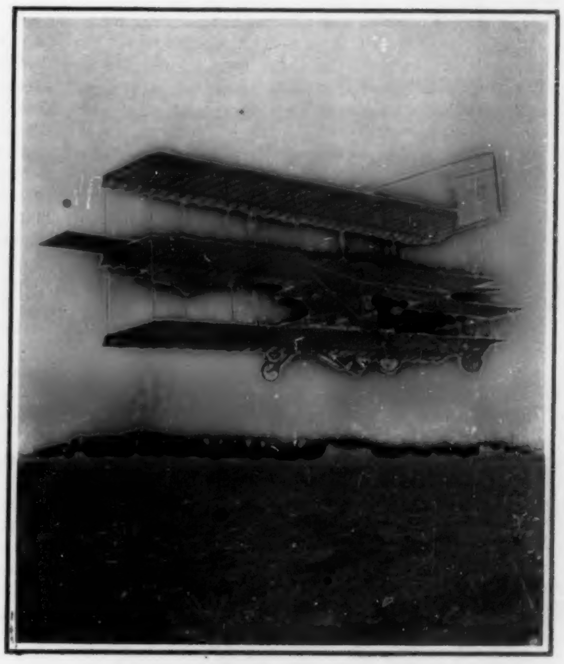
The new aeronautic industry has already assumed such proportions in France, that the first Aeronautic Salon was held recently in the Grand Palais at Paris. The Salon was held in conjunction with an exhibition of commercial motor vehicles, which also proved very interesting to the public.

In our illustrations this week we show some of the new aeroplanes which have recently been brought out in France, and several of which were exhibited at the Salon.

The aeroplane of greatest interest is the new double-surface Bleriot machine, shown herewith. Bleriot, it will be remembered, is one of the most thorough and daring experimenters in the art of aerial navigation. He has built numerous machines, among them several of the Langley following-plane type, with which he made successful flights. Latterly he has experimented with monoplanes, as the monoplane is a more advanced

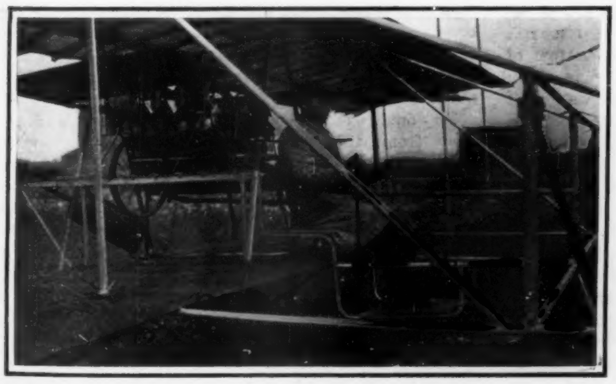
An aerial torpedo dirigible attacking a warship at sea.

In illustrating the use of a novel type of dirigible the artist has forgotten the vulnerability of this huge ship of the air.



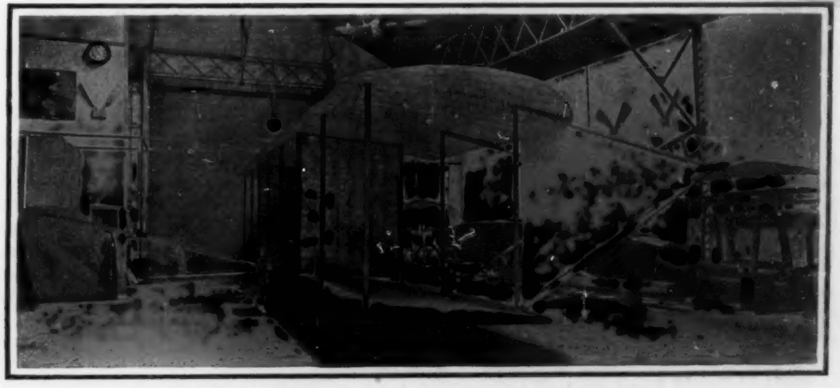
The Vaniman triplane in flight.

The vertical and horizontal rudders in front, the movable wing tips at the ends, and the stabilizing tail behind are all clearly shown in this photograph.



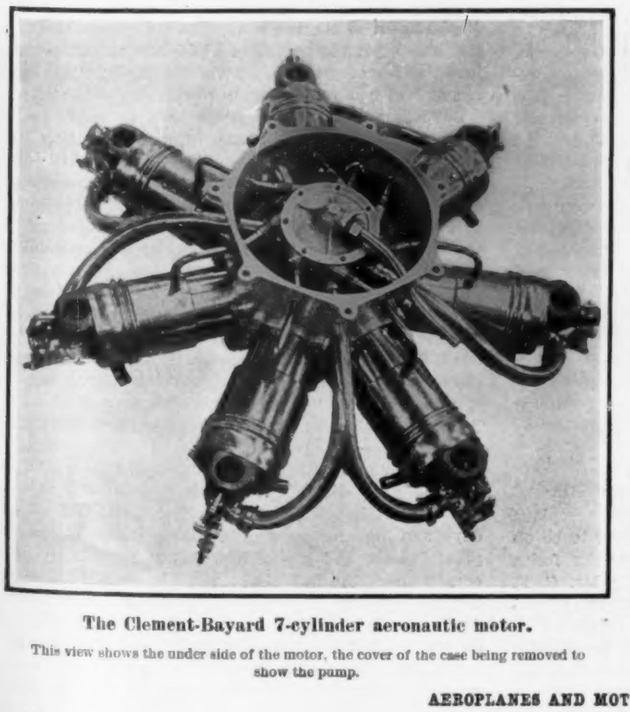
Melvin Vaniman at the control levers of his three-deck aeroplane.

The 8-cylinder motor and one blade of the propeller are seen back of the aviator. The radiator is also visible above the motor at the left.



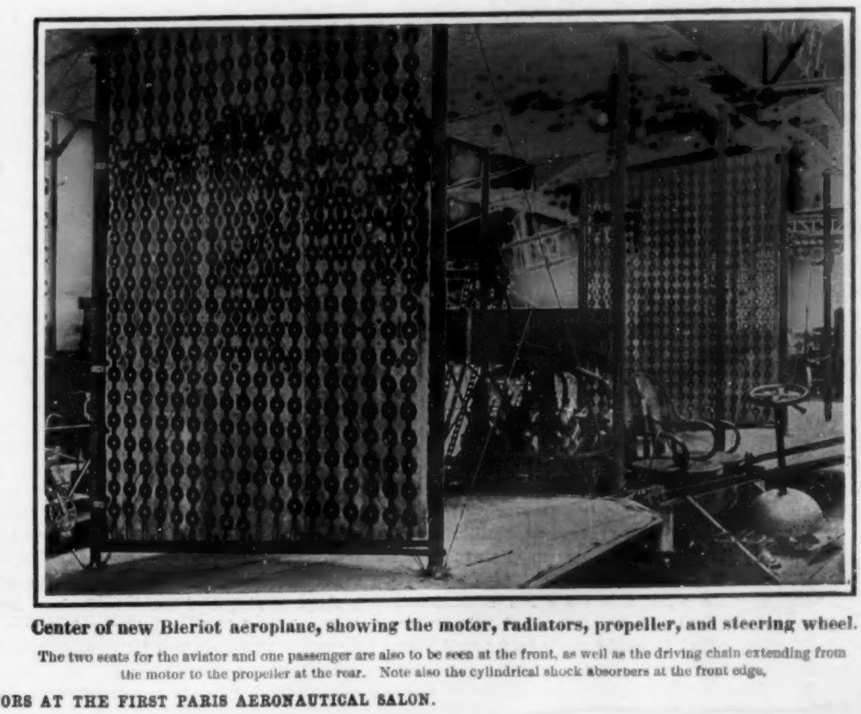
End view of the new Bleriot two-surface aeroplane.

The triple vertical rudders are seen in front (at the extreme left of the photograph) and the horizontal rudders on the end of the triangular partitions at the rear.



The Clement-Bayard 7-cylinder aeronautic motor.

This view shows the under side of the motor, the cover of the case being removed to show the pump.



Center of new Bleriot aeroplane, showing the motor, radiators, propeller, and steering wheel.

The two seats for the aviator and one passenger are also to be seen at the front, as well as the driving chain extending from the motor to the propeller at the rear. Note also the cylindrical shock absorbers at the front edge.

AEROPLANES AND MOTORS AT THE FIRST PARIS AERONAUTICAL SALON.

type of machine, with which it is possible to obtain the highest speed. On October 31 he made a cross-country flight of about 18 miles, including two stops *en route*, with his monoplane. On November 4 this machine was demolished, and its dangerous character was again shown. Since then he has constructed a new double-surface machine much like the Wrights', yet differing from it in several main features. Chief of these is the replacement of the front horizontal rudder by triple vertical rudders, and the use of separate single-surface horizontal rudders behind the main planes at a distance of several feet. These rudders are carried upon triangular vertical trusses, the outermost of which are covered with cloth. The horizontal rudders, when rigged behind the planes as Bleriot has arranged them, will doubtless be less efficient than if they were in front. Nevertheless, the aviator proposes to sit in a comfortable chair on the front edge of the lower plane, and to steer and control his machine by means of an automobile type steering wheel and a single lever beneath it. The two horizontal rudders, of 8 square meters (86.11 square feet) each, are so connected that a movement of the lever inclines one upward and the other downward a like amount; while pushing forward or pulling backward the steering column causes both to act together for directing the machine upward or downward. Turning the steering wheel operates the triple vertical rudders for steering to one side or the other.

Thus Bleriot accomplishes with but two auxiliary horizontal pivoted surfaces—the same number as has the Wright aeroplane—what the Wrights have to warp the main planes to accomplish, i. e., the maintenance of the transverse stability, in addition to carrying out the main object of these auxiliary surfaces, namely, the directing of the machine up and down.

As Farman has found the use of vertical partitions connecting the main planes to be advantageous, M. Bleriot has placed one of these on each side of the center part of his new aeroplane, in addition to the triangular vertical portions extending back from the rear edge at the ends. The two central partitions, instead of being made merely of cloth, are, however, constructed of sheet aluminium, and made to serve as radiators for cooling the water used in the jackets of the motor. Applied to each surface of the sheet aluminium are a large number of rings of small-sized tubing, connected together by flexible pipes. The cooling water is forced through the large radiating surface thus formed, by a suitable centrifugal pump.

The motor which will first be used on this new aeroplane is a 50-horse-power Antoinette of the 8-cylinder V type. Later, a 100 horse-power 16-cylinder motor may be tried. The 3-meter (9.8-foot) 4-bladed propeller is placed at the rear of the main planes, which are notched at their center rear edges to allow the propeller to be brought farther forward and to be supported on the central rigid part of the structure. This propeller is driven at 480 R.P.M. by a chain from the motor crankshaft. There is a speed reduction of about 3 to 1 from the engine to the propeller. From his experience with his monoplanes, M. Bleriot evidently believes that the gyroscopic effect of this large 4-bladed propeller will not be sufficient to cause trouble with his new double-surface machine.

The main planes of the Bleriot machine have a spread of 12 meters (39.37 feet), and their width from front to back is 2½ meters (8.2 feet). The total supporting surface of the two planes is 60 square meters (645.83 square feet). The weight is given as 480 kilogrammes, or 1,058 pounds, but as M. Bleriot expects to be able to carry two or three passengers, this would make a total weight of from 1,200 to 1,650 pounds. Two passengers are to be carried on the front edge of the machine, and two on the rear. The total length from front to back is 8 meters (26¼ feet). The machine rests upon three very small wheels equipped with large pneumatic tires. On account of the small diameter of the wheels, the lower plane is quite close to the ground, and it will be necessary to alight on an even keel in order not to damage this plane.

The improvements that Bleriot has made upon a machine of the Wright type have caused this to assume a very businesslike appearance. The new machine has sufficiently large radiators to allow it to run for an indefinite period; and the only limit to the length of time it should be able to remain aloft, should be the amount of fuel that can be carried. The 50-horse-power 8-cylinder motor consumes much more fuel per hour than does the 4-cylinder, 25-horse-power motor of the Wright aeroplane, so that in this respect the Wrights doubtless still have a decided advantage. It has yet to be shown, too, whether the combined horizontal rudders and wing tips in the rear will be as efficient for maintaining the transverse equilibrium of the aeroplane as is the Wright system of warping the main surfaces. Bleriot has had considerable experience with movable wing tips upon his monoplanes, however, and he doubtless did not adopt this system without knowing that it would work fairly well.

Another new machine which has recently flown successfully in France is the three-decker of Melvin Vaniman. This is not the first aeroplane of this type to be experimented with, but it is, we believe, the first one which has made a really successful flight. On December 18 last, above the parade ground at Issy-les-Molineaux, it flew a distance of 150 meters (492 feet). Although the aeroplane is mounted upon four wheels, M. Vaniman nevertheless uses the Wright brothers' system of starting from rails; but in his case a track is laid for the aeroplane to run upon, instead of making use of a single rail and a special carriage. The aeroplane rose by its own power, and how well it behaved in the air can be seen from our illustration. The Vaniman three-decker has both its horizontal and vertical rudders placed well out in front. The horizontal rudder is about on a level with the middle plane, while the vertical rudder is placed between this plane and the upper one well out in front, and a tail with horizontal and vertical surfaces is placed on the same horizontal line at the rear. There are also auxiliary planes or wing tips at the ends of the middle plane, for the purpose of maintaining the transverse equilibrium. The machine is equipped with an 8-cylinder Antoinette motor of from 60 to 80 horse-power. The two-bladed propeller is direct-connected to the crankshaft. A pair of horizontal radiators are mounted on a level with the top of the motor, one on either side of it. The aviator sits on a seat arranged in front of the motor, and controls the rudders and equalizing planes by two levers. The distinctive feature of this aeroplane is the fact that the framework is constructed of steel tubing. It is the first successful French machine having its framework made of this material. The advantages of the triple-surface aeroplane consist chiefly in the shortening of the planes, and thus in the making of a less cumbersome machine. Compared with the Farman or the Wright aeroplane, Vaniman's machine is several feet shorter in width. As can be seen from the photograph, it is a very symmetrical and rigid appearing structure; and we have no doubt that before long a machine of this type will make successful and extended flights.

The motor which we illustrate is the new Clement-Bayard, 50-horse-power, 7-cylinder aeronautical engine, which has recently been brought out by the Clement firm. The seven cylinders, each of which is provided with a copper water jacket, are evenly spaced about the central crankcase, and have their connecting rods attached to a single crank. Our photograph shows the under side of the motor, which has a centrifugal pump attached to the lower end of its crankshaft and arranged in a casing, the cover of which is removed. This centrifugal pump forces water to the bottom of the water jacket of each cylinder, there being seven separate outlets from the pump for this purpose. Just above the pump there is an annular mixing chamber, from which four large pipes run to the cylinders. Three of these pipes are branched, so that they supply six of the cylinders, while the fourth one (shown at the right) supplies the seventh cylinder only. The carbureter is placed at one side of the casing, the pipe connecting it with the mixing chamber being seen within this casing, to the right of the uppermost cylinder in our illustration. The inlet and exhaust valves are mechanically operated by a rocker arm and single push rod for each pair of valves. The push rods are worked by a cam ring that is concentric with the crankshaft, and that is driven at half the speed of the latter through an idle lay shaft. A high-tension magneto is placed above the cylinders and is gear-driven from the crankshaft, while on the upper end of the lay shaft just mentioned there is a distributor for supplying current to the spark plugs.

The drawing which we reproduce shows the way in which naval warfare will yet be carried on, according to those most interested in the lighter-than-air type of aerial craft. The dirigible seen in the foreground has discharged a torpedo from its torpedo-shaped car with disastrous results to the warship. The particular feature of the dirigible shown in our illustration is the placing of the torpedo-shaped car quite close to the gas bag, and the suspending of this car from a sort of hot-air turbine, by which the car can be swung in any direction when it is desired to fire at the enemy. This dirigible is a recent French invention, which the enthusiastic inventor believes will soon revolutionize warfare on the sea.

Further particulars of the Paris Aeronautic Salon, together with photographs of some of the noteworthy machines there exhibited, will be found in the current issue of the Supplement, which also contains a very good article upon aeroplane construction.

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Cash Prizes for Aeroplane Flights in America.

Cash prizes to the amount of $1,200 for aeroplane flights were announced last week. The first to be offered was $200 by the magazine Aeronautics for a flight of one-half kilometer. Subsequently Mr. C. F. Bishop, president of the Aero Club of America, offered four prizes of $250 each to the first four aviators who fly one kilometer. The latter flights must be officially controlled and must be made by a machine that has never before flown this distance officially.

THE SCIENTIFIC ASPECT OF EARTHQUAKES AND VOLCANOES.

BY W. J. MURRAY.

The dreadful natural tragedy enacted at the extreme south of Italy and the eastern coast of Sicily cannot fail to awaken the heartfelt sympathy of the whole world for the ill-fated victims of probably one of, if not the most appallingly destructive earthquakes in the annals of seismic disturbances throughout the world. The latest accounts estimate the loss of life at 170,000 to 200,000 people, and it is much to be feared that the total number when fully ascertained may turn out in excess of these figures.

We surely have here the evidence that in the play of cosmic forces nature recks little of consequences. The terrible catastrophe on the shores of the straits of Messina has as little interest for the universe at large as the destruction of a microscopic infusorium or of the smallest bacillus. Both events happen through the operation of a mechanical necessity which throughout nature takes no cognizance of sentient beings, their feelings and their interests.

That from the human point of view, earthquakes are an evil goes without saying; and the worst of it is that it is quite impossible to prevent them, and almost equally impossible to avoid them.

Earthquakes and volcanoes, while different in their localities and modes of manifestation, are undoubtedly due more or less to a common natural cause, viz., the gradual cooling, and consequent shrinking or contracting, of the earth's crust, taken together with the fact of the great body of intense heat in the interior of the earth. A very high temperature must exist at a depth of even a small fraction of the earth's radius. At the depth of say twenty miles, the heat is so great that the most refractory solids, whether minerals or metals, would at once yield if they could be subjected to such temperatures in our laboratories. But none of our experiments can tell us whether, under pressure of thousands of tons on the square inch, the application of any heat whatever would be adequate to convert solids into liquids. It is, therefore, doubtful whether the terms solids and liquids are at all applicable, as we understand them, to materials forming the interior of the earth. As to the immediate cause of earthquakes, there is considerable difference of opinion, as is always the case where a natural problem presents itself for solution outside the domain of what are termed the exact sciences. In all probability, an earthquake is one of the necessary consequences of the gradual cooling of the earth. As the terrestrial heat is gradually declining through its radiation out into space, it follows that the bulk of the earth must be gradually shrinking.

No doubt the diminution of the earth's diameter from this cause must be small, even in a long period of time. But the shrinking is nevertheless continually in operation, and accordingly the crust of the earth has from time to time to accommodate itself to the fact that the whole globe is slowly but surely getting smaller. It follows from these considerations that the rocks forming the earth's crust over the surface of continents, islands, and under the beds of the ocean, must have a declining acreage year after year. So that of necessity the rocks must compress either continuously or occasionally; and their yielding will usually take place in regions where the earth's crust happens to have least power of resistance.

The acts of compression may be and usually are irregular, with small successive shifts; and though the displacement of the rocks in these shifts may be actually small, yet the pressures which the rocks are subjected to are so great that a very small shift may correspond with a very great terrestrial disturbance.

Suppose that there is a slight shift in the rocks in each side of a crack or fissure at, say, a depth of ten miles, where the pressure would be about thirty-five tons to the square inch. Even a slight displacement of one extensive surface over another, the sides being pressed together with a force of thirty-five tons to the square inch, would be an operation accompanied by violence greatly exceeding that which we might expect from so small a displacement, if the forces concerned had been only of more ordinary magnitude. It can be readily understood that these violent movements under the surface of the earth must cause great changes and commotion over-ground, resulting in the wholesale destruction of houses, villages, and even large cities, and in frequently great sacrifice of human life.

When an earthquake occurs under the floor of the sea, at a great distance from land, it does little harm; but when it happens near the shore, as it did a few days ago, on the coast of Southern Italy, it causes great damage and loss of life. When the disturbance occurs under the bed of the sea, the waters above it become uplifted, and the shock spreads outwardly. As the waves approach the shore, the friction or drag on the sea bottom decreases their speed, but greatly increases their height. On a low-lying coast such waves (usually miscalled "tidal waves") are generally

very destructive, which is unfortunately verified in the Italian disasters. Both earthquakes and volcanoes are more frequently found near the sea coast than inland. In the United States, earthquakes are most common in California. There appears to be a seismic zone encircling the world in which earthquakes are more numerous than elsewhere. It includes Central America, West Indies, Azores, Italy, Persia, Afghanistan, Tibet, Japan, and Hawaii. Earthquakes are common in volcanic regions.

Volcanoes are caused in the main by the same conditions and influences that give rise to earthquakes. But they are different in their manifestation. Volcanic eruptions are caused by leakage or percolation of water through cracks or crevices of the earth or rocks in varying quantities—sometimes in large quantities. As it comes in contact with the great heat in the lower parts of the earth's crust, the water is converted into steam. The steam finds violent vent in an explosion that removes the pressure from the lava, which in turn is forced up through the vent.

This internal heat causes evolution of a great body of elastic vapor, which, expanding and seeking an outlet where there is least resistance, shows itself in upheavals and explosive eruptions. The body of vapor supposed to be derived from superficial masses of earth becomes hydrated, or combined with water. Such action, as well as the presence of molten rock known as lava, is accounted for by vast internal displacements, bringing the inner crust with its high temperature nearer the surface. A great portion of the material thus upheaved is lava.

Lava is largely composed of silica and silicates; those containing a relatively small percentage of silica being called basic, and those containing considerable silica, acid. The acid variety of lava is lighter. Sometimes it does not move from the lava vent, and when it does it generally proceeds a short distance only, solidifying into a thick mass. The basic is much more liquid, and covers the slopes of the mountains or forms a lake on the adjacent plains. At the surface the lava is torn apart by the steam, the fragments being hurled high in the air. The fragments are known as cinders, and when finer as ashes. There are also numerous accessory phenomena, such as earthquakes, electric and magnetic disturbances, and acoustic manifestations, accompanying a volcanic eruption.

Both earthquakes and volcanoes have been inseparably bound up with the evolution of our planet for countless ages past, but their duration must have its limit, although that limit may be tens and even hundreds of thousands of years hence.

The present inert and dead condition of our satellite—the moon—once the center of great volcanic activity, points unmistakably to the fate that sooner or later awaits this earth of ours.

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British and German 1909 Warships.

BY PERCIVAL A. HISLAM.

Great secrecy is being maintained concerning the details of the two armored ships to be laid down for the British navy in the current year. The following particulars have, however, been furnished by a reliable authority. The battleship, to be called the "Neptune," will be laid down at Portsmouth, and will follow the same general lines as the "Dreadnought." She will be 510 feet long, with a beam of 82 feet, and her normal displacement will be 20,250 tons. Her main armament will be the same as that of the "Dreadnought"—ten 12-inch guns—but she will probably have 4.7-inch weapons in the anti-torpedo battery. The disposition of the heavy guns will be the same as in the pioneer ship of the class; that is to say, three turrets will be on the center line, one forward and two aft, and one on either beam. The second center-line turret counting from aft will, however, be raised so as to fire over the aftermost, as in the "Michigan" and "South Carolina," thus giving the ship an advantage of two guns over the "Dreadnought" in astern fire. The designed speed of the ship will be 21 knots with turbines of 24,000 horse-power. Plans for a vastly improved battleship are in the possession of the British Admiralty, but will not be used until the ships of the 1909-10 estimates are commenced. The "Neptune" will complete a squadron of eight battleships of the same speed, armament, and general design. She will be completed for sea in the spring of 1911.

The other armored vessel of the 1908-9 programme is a cruiser, named the "Indefatigable," which is to be built at Devonport. This ship will be a greater improvement on the "Indomitable" class than the "Neptune" will be over the "Dreadnought," although the superiority will be largely a nominal one. The "Indefatigable" will be about 570 feet long with a beam of 80 feet, and will displace normally 18,000 tons—700 tons less than the latest German armored cruiser. It will be remembered that all three ships of the "Indomitable" class, although designed for only 25 knots, greatly exceeded this on their trials. The new vessel has been designed for a speed of 28 knots, and if she exceeds the designed figure as much as the "Indomitable" did, she will exceed 30 knots—which is greater than the speed of most of our destroyers. Her horse-power, with Parsons turbines, will be 45,000, or 4,000 more than the horse-power of the "Indomitable." Like the "Neptune," she is to be completed early in 1911, by which time Great Britain will possess eight "Dreadnought" battleships of 21 knots and four all-big-gun cruisers of 28 knots.

The "Indefatigable" will carry the same armament as her predecessors, namely, eight 12-inch guns. In the "Indomitables," however, it has been found very difficult to obtain a broadside of all eight guns, as was sought in the designs, and in the new ship the disposition of the armament will be so altered as to make this operation quite simple.

The German naval estimates for 1909, recently published, plainly indicate the energy with which that nation is pushing forward her naval development. During the coming year Germany will complete her first "Dreadnoughts"—the battleships "Nassau" and "Westfalen," each of 17,760 tons and armed with twelve 11-inch and twelve 6.7-inch guns. In addition, the armored cruiser "Blücher," of 14,600 tons and carrying twelve 8.2-inch and eight 5.8-inch guns, will be completed. The two battleships will join the high sea (or active battle) fleet, but the "Blücher" is destined to relieve the "Fürst Bismarck" on the China station. The 1909 estimates also include the last installments but one for the battleships "Rheinland" and "Posen," each of 17,960 tons and carrying the same armament as the "Nassau" and "Westfalen"; and also for the armored cruiser "F," not yet launched, of 18,700 tons and armed with twelve 11-inch and a number of smaller guns. The speed of all these battleships will be 19 knots, while that of the "Blücher" will be 23, and of the "F" 25 knots, the latter to be obtained with turbine engines of 45,000 horse-power, or 4,000 more than the designed horse-power of the British cruisers of the "Indomitable" class. Two small cruisers—the "Kolberg" and "Ersatz Jagd"—will be completed during the year, as well as a gunboat for river service in China and a division of twelve torpedo-boat destroyers. The cruisers are of 3,740 tons and 25.5 knots, having turbines of 18,000 horse-power, their armament consisting of ten 4.2-inch and a number of smaller guns. The destroyers are of 660 tons and 30 knots.

The other vessels upon which work is to be continued during 1909, and which will not be completed before 1911, are the three battleships to replace the "Beowulf," "Siegfried," and "Oldenburg," the armored cruiser "G," two small cruisers to replace the "Schwalbe" and "Sperber," a division of destroyers (twelve), and a number of submarines. Authentic details of these ships are lacking. During the year a commencement will be made with work on three new battleships, to replace the "Frithjof," "Hildebrand," and "Heimdall," the armored cruiser "H," two small cruisers to replace the "Bussard" and "Falke," twelve torpedo-boat destroyers, a tender for the torpedo experimental division, and several submarines, the latter to cost $2,500,000. Several of the large vessels in the fleet are to be taken in hand for thorough repair, and two floating docks are to be built, one with a lifting capacity of 40,000 tons for the imperial dockyard at Kiel, and one of 1,000 tons (for torpedo craft) for the imperial yard at Danzig.

The programme of warship construction may be summarized as follows:

	To be completed.	To be continued.	To be commenced.
Battleships	2	5	3
Armored cruisers	1	2	1
Small cruisers	2	2	2
Destroyers	12	12	12

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The Current Supplement.

Mr. F. P. Veitch's article on paper-making materials is concluded in current SUPPLEMENT, No. 1725. Mr. W. A. Tookey writes on oil engines. W. Carlile Wallace contributes an article on some recent inventions as applied to steamships. When a man of science is asked what caused the earthquake at Messina, he must confess his ignorance. Dr. F. A. Jaggar shows how very little we know about earthquakes, and outlines the proper method of studying seismic disturbances. "Liebig as a Teacher" is the title of an article which gives an admirable picture of a great chemist's personality. Prof. R. A. Fessenden's paper, giving a brief history of wireless telegraphy, is concluded. The nature and cause of seasickness are explained. Prof. Otto N. Witt, the well-known German chemist, writes instructively on waste and conservation of natural resources; and the issue also contains articles on the first Paris Aeronautic Salon and on the general characteristics and details of construction of French flying machines.

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Weather-resistant Plaster Mortar.—Mix 6 parts of freshly-burned plaster, 3 parts of brick dust, and 4 parts of blast-furnace slag sand with sufficient water, into a mortar and immediately before use add 2 parts of iron filings.

Correspondence.

ORIGIN OF THE WORD "SCIENTIFIC."

To the Editor of the SCIENTIFIC AMERICAN:

The leading dictionary reports as not found the word "scientificus," from which our word "scientific" is derived. Your issue of January 26, 1907, reported the Latin "scientificus" as found in Robert of Lincoln, in or about 1246. Progress may now be reported. In translating Aristotle, Boethius, in the early part of the sixth century, repeatedly uses the word "scientificus," to render Aristotle's "epistemonicos" (see Boethius, vol. 64 of Migne's Latin Patrology, 720 A, 973 C, 993 D, 1039 C). It is well known that these works of Boethius were forgotten until the revival of the thirteenth century, in which Albertus Magnus was the leader. Since then, the interesting word has been the common possession of mankind. It was started in Greek by Aristotle, it was given its Latin form by Boethius, it was introduced into the literature of science by Albertus Magnus. C. W. ERNST.

Boston, Mass.

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AEROPLANES IN WARFARE.

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue of your magazine you represent on your front page a Wright flyer with two men in it making a map of the country of an enemy. In the magazine you state that in all probability the only use for this type of machine will be for scouting, as you consider that the modern open-order formation for infantry will prevent much damage being done by bombs dropped from above. Have you not, however, overlooked the vulnerability of headquarters? Flyers would not trouble infantry, but would make for the opposing headquarters, and how could these be protected in a way that would still allow the staff to see and know what was going on? With Wright flyers common, I can not see how any staff could direct an army and keep itself out of the danger zone. With the safety of the general staff gone, what would become of the *morale* of an army?

In defending a city against an approaching fleet, the possible damage flyers could do is very great. Several hundred of them, each equipped with a bomb of dynamite, could be sent out from a base, each returning, after dropping its bomb, to reload, and this line of flyers could sail out and back for hours, returning simply for bombs and gasoline. These machines could attack a fleet twenty miles out, and what chance would the fleet have of reaching the coast through this rain of dynamite? Flyers and men are cheap where it is a question of destroying battleships.

I am of the opinion that the Wright flyer offers the cheapest method of defense against an opposing force ever invented, and that the effect of its use will be to diminish the cost of self-protection and to decrease the chances of war by so increasing the size of the danger zone as to make war as dangerous to the commander as it is now to the private.

I would be pleased to have you publish this in your magazine, and would like the comments of others on this point. A. A. MERRILL.

Boston, Mass., December 22, 1908.

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MULTI-HULL STEAMSHIPS.

To the Editor of the SCIENTIFIC AMERICAN:

In your article in the SCIENTIFIC AMERICAN for January 9, you give an account of a projected three-hull type of fast ocean steamer, and in your discussion of the matter, you appear to have mixed up the swinging saloon steamer "Bessemer" and the catamaran steamer "Castalia."

As to the newness of the plan, I have in my possession the plans of a ship of the same type, which were patented by a Capt. Coppen, an old North Atlantic captain, who built and ran some of the very first steamships on ocean routes, and which plans he gave me over twenty years ago. You will find these plans discussed in London Engineering or Engineer for that time, also in Preble's "History of Steam Navigation."

The "Bessemer" was a single-hulled ship, of about 350 feet length and 60 feet beam; she had turtle decks at forward and after ends, 48 feet in length, with a freeboard of only 3 feet, while the rest of the hull was covered with a superstructure having a freeboard of 11 feet.

This superstructure contained the swinging saloon, which was hung compass fashion, with the addition of hydraulic buffers, which took up or controlled the motion. The saloon was 70 feet long, 35 feet wide, and 20 feet high. In the two ends of the midship house were located the engines and boilers.

There were two paddlewheels on each side, 106 feet center, 27 feet in diameter, with twelve feathering buckets each.

She was expected to run ferryboat fashion, without having to make a turn. The engines developed 4,600 horse-power, and were expected to drive her 18 to 20 knots. With her low freeboard she could not be driven, as the seas nearly pounded her to pieces.

The "Castalia" was a catamaran of two hulls; her length was 290 feet, beam 60 feet, with a well or space of 26 feet between the hulls, in which were two paddle-wheels abreast on independent shafts, each wheel run by two separate sets of engines.

Great speed was expected, but she did no better than the vessels then used in crossing the Channel; in fact, she was not their equal, as the seas choked the wheels. She was laid up, finally sold, and on her deck were built a number of houses, and she became a floating hospital.

The "Castalia" was built in 1873, and the "Bessemer" in 1875.

The Engineer and Engineering for those dates have, I am told, articles thereon. See also Preble's "History of Steam Navigation," pages 247 to 249, 278, and 410.

In Capt. Coppen's plans, the central hull is considerably shorter than the wing hulls, and he has the propellers arranged at each end of this central hull, in the manner of our new-style ferryboat, as first placed in the Hoboken ferryboat "Bergen"—one to pull, the other to push. JAMES M. LINCOLN.

New York, January 7, 1909.

THE MEAT INDUSTRY OF AMERICA.—I.

AMERICA is the home of colossal industries. The American people have a genius for organization which has found expression in certain aggregations of men, machinery, and capital which are among the wonders of our twentieth century civilization. Conspicuous among these is the vast meat industry, which in the range of its operations, from the multitudinous flocks on hillside and plain to the fresh meat or canned product as delivered to the individual householder, involves the employment of hundreds of thousands of men and the turning over of money that must be reckoned by the thousand millions.

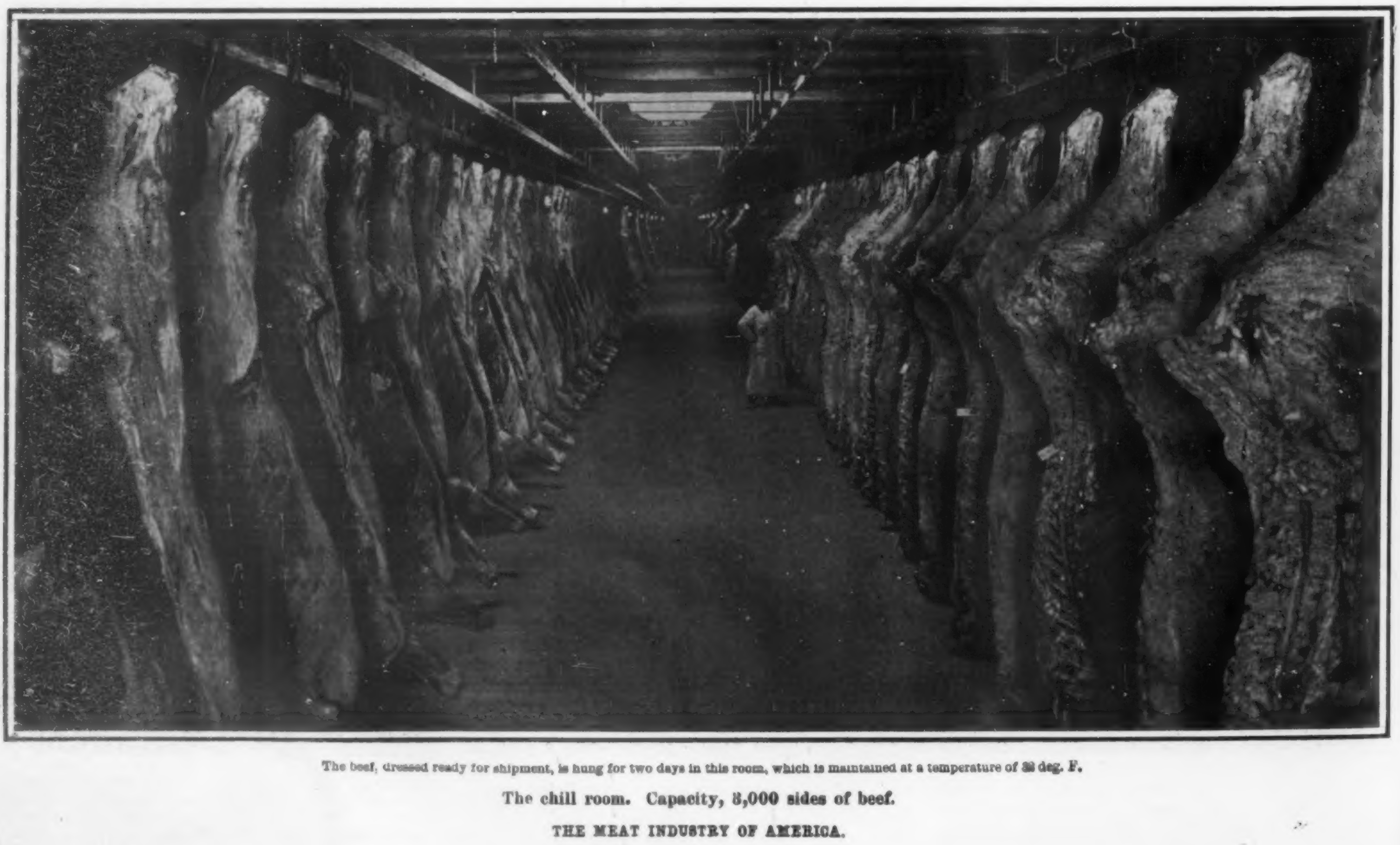
The latest estimate of the value of meat animals on farms and ranges, made by the Department of Agriculture, January 1, 1907, is $2,152,320,349. In 1905 the value of live-stock farms and ranges was estimated to be nearly eight billion dollars, and the capital directly related to meat production for export alone is $10,625,000,000, or five-sixths as large as all capital invested in manufacturing in 1904. It is estimated that the farm value of the available slaughter of 1907 will be worth at the farm at least $730,000,000.

In the development of the great industries of the United States to which we have referred above, there is a tendency to concentration at certain cities which, by virtue of their geographical location or other strategic advantages, are particularly well placed to serve as the centers of activity. Conspicuous among these is Chicago, which holds the same relation to the meat industry that Pittsburg does to steel. Sixty-four per cent of the population of the United States is east of Chicago; while seventy per cent of the farm animals lie to the west of that city. The great east and west transportation lines have their terminals there, as have also the southern railways and the lake transportation lines. The pre-eminence of Chicago in the meat industry is shown by the fact that since 1900 there has been marketed and sold in Chicago a yearly average of over 16,000,000 animals, valued at over three hundred million dollars, and that this number is about half the total combined receipts of the six principal live stock markets of the United States.

The meat industry of Chicago, from the purchase of the live stock to the shipment of the meat, in either the fresh or the cured condition, is carried on at the Union Stock Yards, which are located near the outskirts of the city. The yards cover exactly a square mile of ground. One-half of this area is covered with cattle pens, and the other half by the huge establishments of the packing houses. The pens are surrounded by stout stockades about shoulder-high, and they are laid out in blocks with streets and alleys, in much the same fashion as an ordinary American town. The whole of this area, a half mile in width, and a mile in length, is paved with red brick; and here we see the first notable evidence of the effort to maintain the stock yards in a sanitary condition. The brick paving makes it possible to thoroughly clean both pens and streets, and this is done at regular and frequent intervals. At the time of our visit, although there had been several days of drizzling rain, the yards presented conditions of cleanliness superior to those which can be found in the farmyard of the average American farm, and comparable to those of a well-appointed livery stable.

The stockyard pens, where the cattle are purchased for the packing houses. One of the United States inspectors who examine the cattle on the hoof is seen in the foreground.

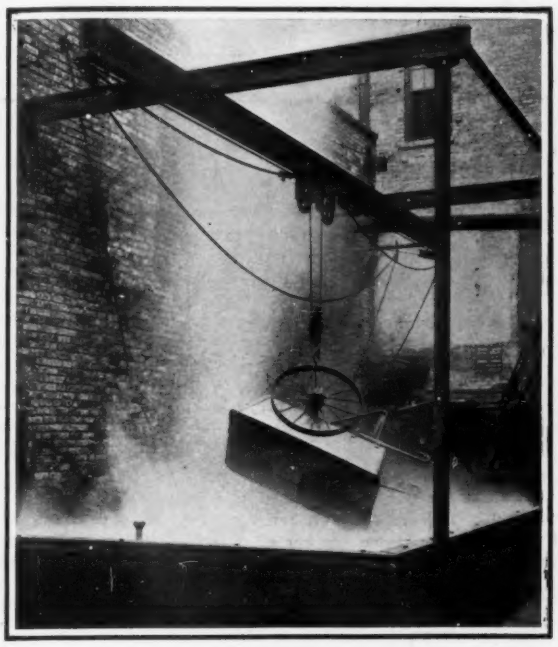
Whatever may have been the conditions in the past, it is a fact that to-day the greatest care is exercised in the shipment and handling of the stock from the time it leaves the farm until it enters the packing houses. The price that the animals will fetch in the pens depends upon the condition they present under the eye of the buyer who represents the packing houses; and it is to the interest of the farmers, the cattle-men, and the commission men to whom the cattle are consigned at the yards, that they shall receive the best food and the most careful attention up to the very hour at which the sale is made. They are shipped in special stock cars, in which they are carried as expeditiously as possible to the stock yards, where they are unloaded and driven to the pens. Here they are at once fed and watered, each pen containing a feeding trough and a water trough into which a stream of fresh water is kept running. The cattlemen consign their stock to the various commission houses, and for receiving and selling the stock there is a charge of respectively twenty-five cents and fifty cents a head. The purchase of the cattle is made by buyers, of whom each of the packing houses maintains a regular staff. To enable the writer of the present article to judge of the condition of the yards and determine for himself how far the



The beef, dressed ready for shipment, is hung for two days in this room, which is maintained at a temperature of 32 deg. F.

The chill room. Capacity, 8,000 sides of beef.

THE MEAT INDUSTRY OF AMERICA.



The trucks in which the meat is handled are periodically sterilized by plunging them bodily into a vat of boiling water.

Sterilizing a box truck.

This interior view of a refrigerator car shows how the beef, during its journey to the branch distributing house, is hung in a refrigerated atmosphere similar to that in the chill room.

Loading the beef into the refrigerator car.

conditions of buying and selling warranted the oft-repeated statement of the newspapers that the market is controlled in the interests of the packing houses, he secured a horse and took an opportunity to ride into the pens and listen to the bidding as carried on between the buyers and the commission men. It must be confessed that the observations of that two hours spent in the pens left the impression that the competition was keen, the commission men trying to get the best possible price for the farmer and the buyers the lowest possible figure for their respective houses. This conviction is deepened by the fact that the supply of cattle seems to be less than the demand for the trade, and always less than the capacity of the packing houses; that there is a natural rivalry between the houses themselves to show the largest output; and that, since the profit of the commission men is at a fixed rate of fifty cents per head, there is a natural desire on their part to sell all that they can at the highest possible figure; for the commission men who secure the reputation for obtaining high prices will naturally command the confidence and trade of the stock raisers. As regards the buyer, it may be said that the margin of profit is so small, being about two per cent in the case of Swift & Co., whose buyer the present writer accompanied during the morning's work, that the prosperity of the house may be said to depend more upon his judgment of the condition of the cattle, and skill in securing the lowest prices, than upon the efforts of any single individual concerned in the business. It is claimed by the Stock Exchange Protective Association, which was formed to safeguard the interests of those who ship their stock to the yards, that the scale of trading morality is exceedingly high, and that an instance of "shady work" on the part either of commission men or buyers is practically unknown. The buyer, accompanied by the commission man, rides into a pen of cattle; looks them over with a rapid glance of his thoroughly practised eye, and quickly decides whether he will buy at the price demanded. In one particular case, of which note was made, the following laconic conversation occurred: The buyer: "Six fifty." The commission man: "Make it seventy-five." "See you later," says the buyer, and drives out of the pen, explaining to the writer that in his judgment the market will be lower as the day wears on. We next entered a pen containing what the buyer defined as prime, corn-fed cattle. Question: "What are you asking?" Answer: "Seven seventy." "Make it seven fifty." The commission man refuses to come below his first figure; but as we ride out of the pen, calls out "Sixty," and the buyer immediately answers "Weigh 'em," explaining that this signifies that the deal is consummated and the cattle are to be driven to the scales preparatory to going to the house of Swift & Co. for killing. We had the curiosity to ask the buyer what was the sum of money involved in a transaction that took less than thirty seconds to complete, and found that it amounted to over $7,000.

Before following the stock to the packing house, it will be well to make some general observations upon the scope and purpose of the vast buildings which occupy that other half square mile of ground adjacent to the pens. The complicated organization represented by these establishments has for its object the dressing

Tank containing bichloride of mercury solution in which dressing tools are disinfected.

Centrifugal drier for washing cloths used in the dressing of the beef.

Washing down the sides of beef with a brush through which flows a stream of fresh water.

THE MEAT INDUSTRY OF AMERICA.

and preparation of the meat, either by refrigeration or curing, in such a way that it will stand a journey to any part of the world and reach the retail dealer in a perfectly clean, wholesome, and palatable condition.

Broadly speaking, there are three methods of preservation, namely, refrigeration, curing, and canning. The present article will deal with the methods of refrigeration and curing as carried on at the establishment of Swift & Co., through whose courtesy we obtained ample opportunities to examine every detail of their plant during a recent visit to the stock yards. The art of meat preservation may be described as a process for the arresting of that law of nature by which all animal tissue, as soon as life is extinct, tends to become resolved by a process of deterioration into its chemical constituents. This can be done either by lowering the temperature of the meat to a point below that at which the bacteria are active, or by treating it with certain salts and substances which secure the same effect. It will be evident at once that the very first requisite in work of this character is that the animals must be absolutely healthy and in first-class condition.

One of the strongest impressions produced upon a visitor to the packing houses is that every possible precaution is being taken to insure the entrance only of healthy animals into the dressing room, and provide for the detection and removal of any that excite the slightest suspicion. This part of the work is in the hands of the United States government, and is under the immediate supervision of the United States Department of Agriculture. The inspection is divided into two kinds—the *ante mortem*, which takes place when the cattle are unloaded into the stock pens, where any animal which by its appearance or actions indicates that it is not in perfect condition is rejected or held for further examination; and the *post mortem*, which takes place after the killing, and consists in a careful examination of the various organs. The *post mortem* examination is made at various points during the process of cutting up, and is continued on the dressed and cured meats up to the very hour of shipment. The personnel of the inspection corps is made up of men who must have successfully completed a three years' course in veterinary medicine at a reputable veterinary college. The Civil Service Commission examines these graduates and about 50 per cent of those examined make the desired grade of 70. The salaries are generous and the promotion of men to higher positions is dependent upon ability. The force is divided into the head inspectors; the laboratory inspectors, who have to pass a civil service examination in bacteriology and chemistry; the inspector's assistants, who examine live stock, stamp the meat, seal the cars, and superintend the removal of condemned meat; and the meat inspectors, who are experts in pickling, salting, smoking, and otherwise curing the meat. We made it a point to converse with several of these men and found them to be intelligent and zealously interested in their work. They stated that the packing-house management was disposed to give hearty co-operation, realizing that the more satisfied the public was of the thoroughness and unbiased character of the work, the better it would be for the houses concerned.

The cattle, after inspection and purchase in the pens, are driven along runways to the dressing floor. The animal is stunned by a blow with a large hammer and hoisted by means of a shackle attached to the hind legs onto the rail of an overhead tramway. While in an insensible condition it is dispatched by severing the principal arteries in the neck. It is then carried forward on the rail; and the operations of dressing follow in quick succession. First the lower joints of the legs are removed, and then the "sider" skins the animal as far down as he can without exposing the parts to contact with the floor. The animal is next opened and the viscera are removed. By means of saw and cleaver the beef is then split entirely in two through the vertebræ. The rough pieces of meat, the spinal cord and other portions are then removed by the trimmers. Next the separated parts are moved down the rail in front of long benches, where other workmen give them a thorough washing with hot water, using a stiff brush from the center of which a hose throws a stream of water against the meat, which is subsequently wiped thoroughly dry with clean cloths. By this time the beef is ready to be passed on to the chill room.

During these various processes the meat has been subjected to careful scrutiny on the part of a United States inspector. When the head is severed an inspector examines the glands which are the common seat of tubercular trouble. At the removal of the viscera another inspector is on the lookout for any indication of abnormality. If there is any evidence of disease, the inspector attaches to the animal a tag on which are the words "U. S. Retained." This tag is numbered to correspond with the number on the stub, which latter he forwards to the office of the inspector with his report. The suspected animal, with any parts which may have been already separated from it, is placed in an iron truck, wheeled away under the eye of the inspector, and locked up in what is known as the "retaining room," the keys of which never pass out of the hands of the government officials. In this room the animal undergoes a final and more thorough inspection, and upon condemnation it is removed and completely destroyed.

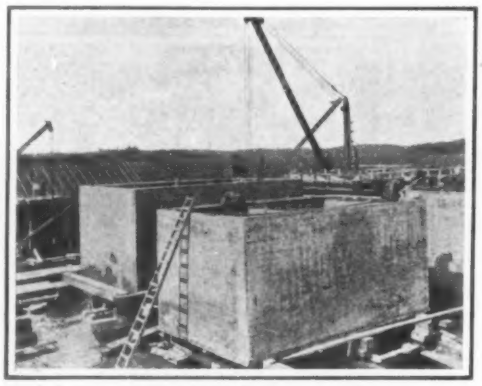


Fig. 1.—Building the caisson.

Returning now to the sides of beef which have been dressed, washed, and wiped, and have passed the inspection above referred to, the government inspector marks each with a metal or rubber stamp which reads "U. S. Inspected and Passed," and the sides are then wheeled along the overhead rail into a vast apartment known as the chill room, where they are held at a temperature of about 36 deg. F. for forty-eight hours. In the chill room, at the time of our visit, some three thousand sides of beef were hanging. Here, during the time the beef is maintained at the temperature stated, it is subjected to a continual circulation of cold air by a process known as the moist refrigeration method, which is designed not only to reduce the temperature of the air, but also to rid it of bacteria, dust, and other impurities. The cooling and cleansing of the air is done in a large chamber immediately above the refrigerating room. Here are suspended, in long rows extending entirely across the chamber, thousands of large sheets of burlap, over each of which trickles continuously a stream of cold brine. The air, drawn in from the outside, is caused to pass between the burlap, where any dust and bacteria which may be in the outer atmosphere are deposited, and the temperature is lowered to the desired point. After passing the burlap, the pure air falls by its own gravity through openings in the floor, arranged directly above the sides of beef in the room below. From the refrigerating room the beef that is to be shipped is wheeled out on overhead rails into the refrigerator cars, where it is hung in symmetrical rows on hooks suspended from the ceiling. At each end of the car is a narrow compartment walled off by boarding which extends from floor to ceiling, but is provided with openings at top and bottom for the circulation of the air; and in these compartments are placed tanks loaded with ice and salt. The air passes in through the vents at the top; is cooled; and falls by gravity to the bottom, whence it issues into the body of the car, a constant circulation of cold air being thus secured.


Fig. 2.—Launching the caisson.

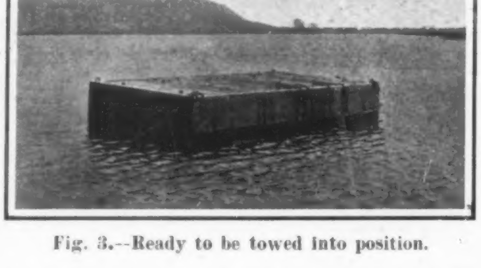


Fig. 3.—Ready to be towed into position.


Fig. 4.—Section of completed breakwater.

CONCRETE STEEL CAISSONS.

There are in various parts of the country over three hundred local Swift & Co. distributing houses, where on the arrival of cars the meat is wheeled out on over-head rails into refrigerator rooms, from which it is purchased by the various retail dealers.

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CONCRETE STEEL CAISSONS.

A new type of breakwater is being built at Algoma, Wis., of reinforced concrete caissons. These caissons are huge hollow blocks of reinforced concrete, each weighing 120 tons in air. They are 24 feet in length, 15 feet in width, and 12 feet 4 inches in height. They are built over launching ways and are launched like a vessel. After launching they are towed a distance of twelve miles to the harbor, where they are used in the construction of a breakwater.

In the breakwater they rest on a foundation of piles which are cut off 11 feet 4 inches under water. When the foundation has been prepared, the caissons are brought into the proper position and sunk by the admission of water into the hollow compartments. After the caissons have come to a firm bearing, the water is displaced by riprap stone, and this is sealed over with four feet of solid concrete. A superstructure with its crown three feet above the caissons completes the breakwater, which is protected on both sides by riprap.

Fig. 1 shows several caissons on the stocks; Fig. 2 shows one of these large blocks being launched. One of the caissons is shown afloat in Fig. 3, and Fig. 4 shows the finished breakwater.

These caissons were invented by Major W. V. Judson, who holds a patent covering the invention, and under whose supervision the above breakwater was designed and built.

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Disposal of the Heany Patent Fraud Case.

The Heany patent fraud case, which involved a Patent Office examiner, N. W. Barton; a patent attorney, Henry E. Everding; and the inventor, John Allen Heany, himself, has been decided at Washington. Barton withdrew his plea of not guilty, and pleaded guilty. Everding practically admitted guilt to some of the charges, but denied guilt of any wrongful act in connection with one of the applications. Heany offered no evidence whatever. A verdict of guilty was brought in against Barton and Everding. Heany, the inventor, was acquitted.

The case in question involves the tungsten lamp patents, and the ultimate outcome will be watched with much interest.

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Official Meteorological Summary, New York, N. Y., December, 1908.

Atmospheric pressure: Highest, 30.53; lowest, 29.38; mean, 30.06. Temperature: Highest, 64; date, 12th; lowest, 20; date, 10th; mean of warmest day, 52; date, 1st; coolest day, 26; date, 10th; mean of maximum for the month, 40.9; mean of minimum, 29.5; absolute mean, 35.2; normal, 34.1; excess compared with mean of 38 years, 1.1. Warmest mean temperature of December, 42, in 1891. Coldest mean, 25, in 1876. Absolute maximum and minimum for this month for 38 years, 68 and —6. Precipitation: 3.21; greatest in 24 hours, 1.91; date, 6th and 7th; average of this month for 38 years, 3.38. Deficiency, 0.17. Greatest December precipitation, 6.66, in 1884; least, 0.95, in 1877. Wind: Prevailing direction, west; total movement, 10,712 miles; average hourly velocity, 14.4 miles; maximum velocity, 50 miles per hour. Weather: Clear days, 7; partly cloudy, 9; cloudy, 15; on which 0.01 inch or more of precipitation occurred, 10. Snowfall, 5.1; sleet, 4th; fog (dense), 12th, 18th, 31st.

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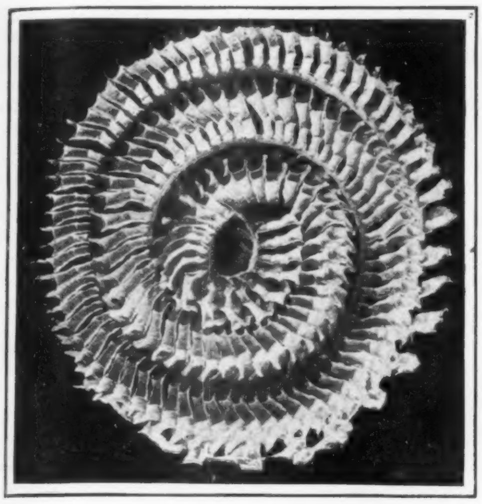
A new system of road-making, which, it is claimed, will stand the wear and tear of heavy traffic, such as motor wagons, and be virtually dustless, is to be tried on a more extended scale by the Lancashire County Council. It has already been tested on short lengths of road, and after four years' hard use the road shows no sign of wear. It is made with small granite sets 3½ inches to 3¾ inches, laid in intersecting circles. This method of paving is said to be much more economical than paving with ordinary granite. At the instance of the County Council the system is to be tried on a length of main road between Accrington and Haslingden.

CURIOUS LIFE HISTORIES.

THE STRANGE DEVELOPMENTS OF SOME INSECTS AND ANIMALS.

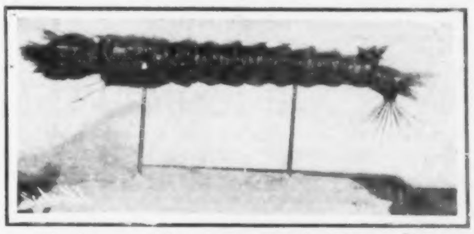
Few things in natural history are more curious and interesting than the strange metamorphoses through which some lower forms of life pass before attaining their final stage of growth. As is often the case in other lines of development, it is the least visible which is the most important part. The clothes moth, which is so often credited with fretting our woolens, does all its destructive work when it is a grub. So little has food to do with its final state, that the moth has not even a mouth. The heavy flying cicadas or locusts, which periodically appear in some sections of the country, have brief lives as flying insects; they lay their eggs to insure the next generation, and then their work is done. But as larvæ they have been living, under the soil, for a number of years—with some species for seventeen years. And so these flying cicadas that we see are really of an age to which some large animals, such as dogs or cows, seldom attain.

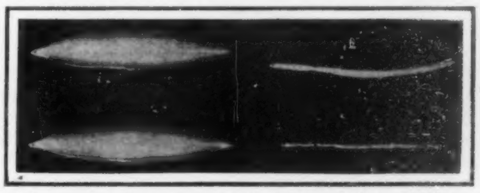

The numerous egg sacs of the conch, a large shellfish.

There is no uniform rule governing these changes. A butterfly spends its caterpillar existence crawling from leaf to leaf, and does not become a freely-roaming creature until it has emerged from the chrysalis. "Baby" oysters or lobsters are free-swimming creatures at an early age, but later in life one attaches itself to a spot from which it never moves, while the other, not quite so anchored, finds some convenient hole or crevice in a rock, and stays in its vicinity.

The various stages of growth tend to illustrate the evolution from a lower type. To repeat an oft-quoted example, a very young baby has such a strong grip that if it takes firm hold of a stick or a rope, it may be lifted without relaxing its hold; possibly a memory of the days when our ancestors were tree dwellers. An example of this development is seen in the frog, which hatches from an egg into a gill-breathing tadpole, and later, as it grows legs and absorbs its tail, develops lungs, and becomes an air-breathing creature. The platypus, a curious mammal of South Australia, actually lays eggs, from which its young are hatched; the hoazin, a large South American bird, when a nestling has a claw on each wing, which enables it to scramble about trees. At this stage it develops reptile-like traits. Many winged insects pass the earlier stages of their existence as water dwellers. The commonest instance of this (in some sections of the country) is the mosquito, the larvæ of which, known as "wrigglers," swarm in stagnant water. This water existence, by the way, has proved the mosquito's vulnerable point. By draining or by pouring oil on the surface of the water, their breeding haunts have been broken up in many quarters, and the insects exterminated.

The sea is as full of changing life as the land. The receding tide often leaves strange wreckage behind it. One common and distinctive object is the egg case of the conch. As it lies stranded on the beach, it is curled in the shape of the well-known shell from which it has come. Each of the several hundred egg sacs in the chain contains eggs, or, later, tiny conches in tiny shells. Were this egg chain never cast up, but always safely anchored below low-water level, naturalists might still be speculating as to the early days of the conch as they did until recently when discussing the eel. There used to be a theory that eels were spontaneously evolved from mud; a type of theory which had many applications in the days before nature study became a science. The mud theory was long ago abandoned, but naturalists searched in vain for a long time before they found tiny eels. At certain seasons of the year some rivers swarm with eels making their way upstream, and it was thought that the young must be looked for in the ocean. This supposition is now proved correct; but the baby eels when found resemble flatfish, and do not assume their snake-like shape until later.

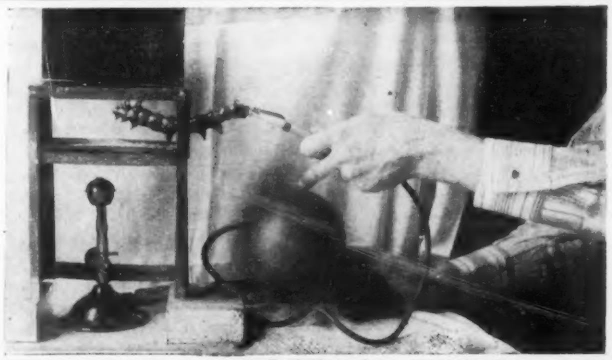

The larva of the common malarial mosquito.

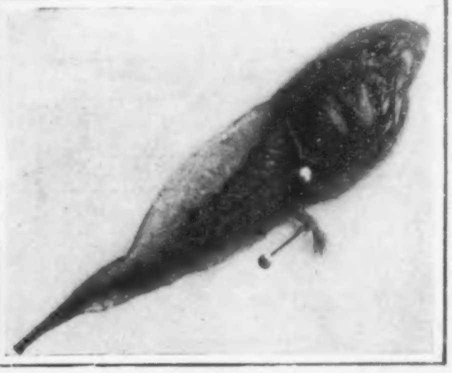

The young of eels are at first shaped like flatfish.

The jellyfish of the ocean are also creatures with curious young. It is difficult sometimes for an inexperienced observer to decide whether they are plants or animals. There are jellyfish on which the young grow like fruit, and when "ripe" drop off to lead a separate existence; others trail a string of young on a long rope, and similarly shed them when able to fend for themselves.

To multiply instances of strange forms of young would be to go through the greater number of the lower forms of life.


Free-swimming young lobsters eight days after their birth.

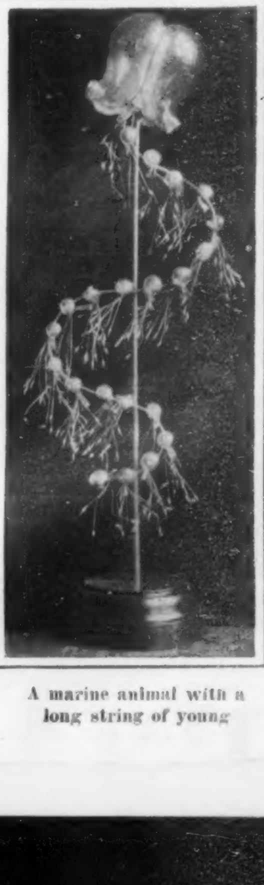

Preparing a specimen for a museum. The skin is first emptied, then inflated, and finally heated in an oven.


A tadpole just commencing to grow the hind legs.


The "hickory horned devil," the grub of a moth.


A jellyfish that bears its young like fruit and sheds them when ripe.


The young hoazins climb about trees after the manner of reptiles.


A marine animal with a long string of young

CURIOUS LIFE HISTORIES.

The Editor of Handy Man's Workshop will be glad to receive any hints for this department and pay for them if available.

TWO WAYS OF IMPROVING A SLED.

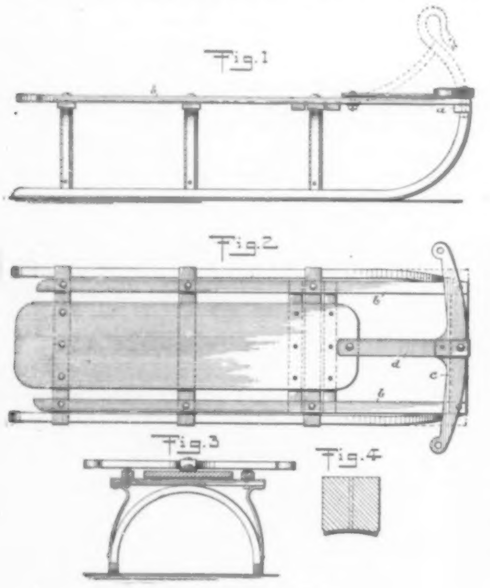
BY J. A. BERGSTROM.

The accompanying illustrations show how an ordinary sled may be converted into a dirigible sled, and how it may be combined with a boy's hand car to make a motor sled.

THE DIRIGIBLE SLED.

Unlike the ordinary sled, that is steered by digging in the heels, or dragging the feet in the snow, from one side to the other, thereby checking the speed of the sled, the sled here shown has flexible runners, which may be curved to one side or the other by a steering bar, causing the runners to follow smoothly in the curving tracks. The sled should be built low and narrow, and the runners should extend well forward and rearward, which will materially add to the speed of the sled when coasting down a hill.

Fig. 1 shows an ordinary girl's sled, which is made into a flexible or dirigible sled. The top part of the runners, shown in dotted lines, is cut off on a level with the seat and the ends are fastened together with a transverse bar *a*, made of iron or wood. From this bar, and fastened thereto, are bars *b*, one on each side of the seat and parallel therewith. These bars are fastened to all the standards of the sled. On the front bar is fastened a steering lever *c*, which is fulcrumed by the rearwardly-extending arms *d* to the front part of the seat of the sled. It is now evident that when the operator wishes to steer to the right, he presses the lever with the left foot, and *vice versa*. As the steering lever is thus moved, it will be noticed that it moves the transverse bar to one side or the other, thereby curving the runners in the same direction, which will then follow smoothly in the curved tracks.



A DIRIGIBLE SLED.

It will be noticed from the plan view, Fig. 2, that the end standard is bolted to the seat of the sled, and that the other two standards are not, so as to allow a free movement of the runners when operated upon by the steering lever.

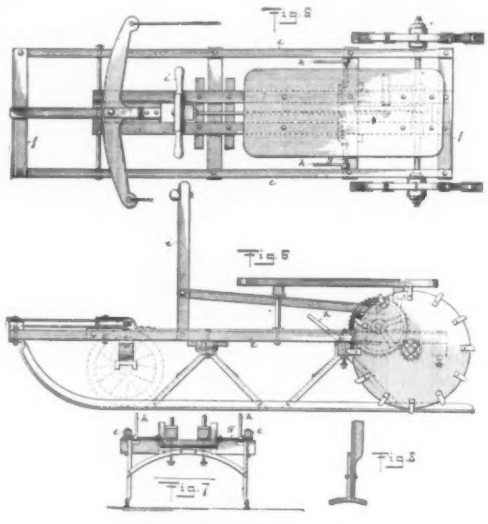
Two pieces of wood should be fastened under the seat, a short distance each side of the forward standard, to allow for side movement.

The old iron shoes on the wood runners should be taken off and curved or hollowed as shown in Fig. 4, or may be replaced by new ones. By referring to Fig. 12, it will be seen how this curving of the shoe may be accomplished. A shallow groove is made in a block of hard wood, over which the thin steel shoe is placed. A short piece of round iron is laid on the shoe top; the latter is then hammered into the groove, assuming the hollowed or concave form.

Rivet the shoe on the runner, which should be hollowed out a little to fit. The object of the concave form of runners is the same as that of hollow ground skates. The outside edges have a tendency to dig into the ice or snow, and keep the sled in its course, or in "the same rut"; but when thrown out of line with the steering lever, they seem to take hold of the snow and change the course of the sled.

THE HAND MOTOR SLED.

The motor sled, which should appeal to almost any boy, is made by combining a flexible sled with an ordinary hand car, such as sold by toy dealers. The rear wheels are taken off and substituted for a pair of traction wheels, which may be thrown in or out of commission by a suitable lever, within the reach of the operator.



THE HAND-MOTOR SLED.

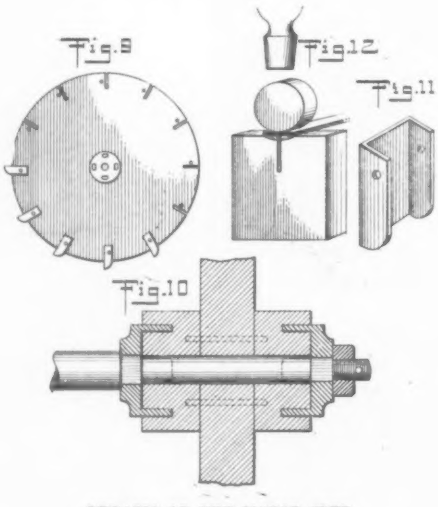
The sled may be of any steerable kind now on the market, or it can easily be built by almost any amateur, to suit the hand car to be used. The material may be bought from almost any hardware dealer. The runners are made for an ordinary size sled, from ½-inch by ⅝-inch T iron or steel, or they may be made from two angle irons riveted together. The base of the T should be bent or curved downward, so as to make it slightly dished out in the center. This can be done as before described. See Fig. 12.

The runners are now ready to be bent to suit the height of the sled. There may be two or more standards, according to the length of the sled. They can be made of angle iron, riveted to the runners, and fastened to transverse bars of wood at the top, and braced together if found necessary, so as to make them stiff.

To these standards are fastened, one on each side, and directly on top of each respective runner, wooden rails *e*. These rails are fastened together with transverse bars *f*, at the front and rear ends. Directly over the rear standard, and journaled into the outside rails *e*, is a crankshaft *g*, provided with suitable handles *h*. At the front end, and directly over the front axle, the steering lever is fulcrumed, and two extending arms fastened thereto, which are connected with the front bar *f* by a bolt passing through slots in the arms.

The sled is now ready to receive the hand car, which is placed in the center of same. The front end is fastened to the outside rails *e* with a long bolt, forming a hinge for the car.

Long bolts with nuts at their lower ends are now passed through the frame of the car into the rear transverse bar, also into the rear standard. Two pieces of wood may be nailed or screwed to the rear standard, forming a guide for the up-and-down movement of the car.



DETAILS OF THE MOTOR SLED.

It will now be seen that by moving the handle *h* to the rear, the crank *g* will lift the rear end of the hand car relatively to the sled, thereby elevating the traction-wheels from contact with the ice or snow. It will also be seen that the handle *h* will rest on top of the standard, and that the crank *g* has passed the center of the shaft, and is consequently locked in this position.

The traction wheels are made of hard wood. First cut out a disk (see Fig. 9) about the same size as the wheels of the car. Then cut a number of radial slits in the periphery of same, into which are inserted small galvanized-iron buckets, shown in Fig. 11, and riveted thereto. Small round disks are now fastened to either side of the large disk, so as to make the proper length of the hub. Into these small disks are made four elongated recesses, to fit the four outward-extending prongs of the fixed collars on the shaft; and when screwed together with the nut on the outer end thereof, will keep the large disk fast on the shaft, and will rotate with same. See Fig. 10.

The sled may be propelled by operating the handle *h*, and steered by means of the foot-lever, like the sled described above.

It will be possible to propel the sled up a hill, or go a round-about way to get there. Then by throwing the lever *h*, the traction wheels may be elevated above the runners, so they will not interfere with coasting down hill.

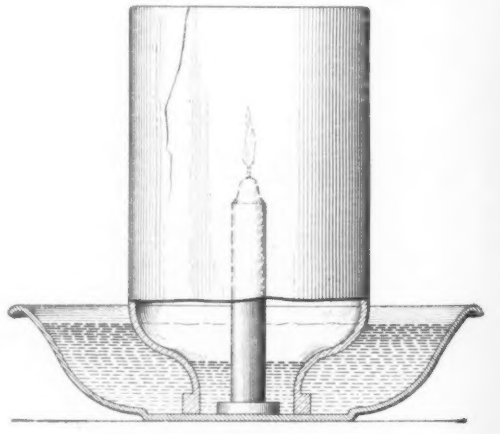
◆

MENDING A CRACKED BOTTLE.

BY W. J. C.

A very neat way to mend a piece of cracked glassware with sodium silicate or water-glass came to my notice some weeks ago. A cut glass decanter which the owner valued very highly had a bad crack running irregularly around the bottom and partly up the side. In addition to preventing its use, it rendered it unsightly.

To remove all appearance of the crack, the decanter was warmed slowly and then sealed with its own ground stopper. The water-glass was then applied with a broad brush on the outside of the crack, and as the air cooled inside the external pressure forced it into the crack, which completely disappeared and was rendered perfectly water tight to cold water at least.



MENDING A CRACKED BOTTLE

Since seeing the above I have tried the same operation with success on a wide-mouthed jar, but obtained a much better vacuum and therefore better results without heating the jar.

I took a deep basin, and in the center arranged a candle as shown in cut. The basin was then filled with water and the cracked jar inverted over the lighted candle; as the air in the jar was consumed by the candle, it was slowly lowered into the water which effectively sealed it. The water-glass was then applied as in the previous operation and the whole left to harden. The water-glass takes six to eight hours to set and then the outside of the bottle or jar can be washed with a cloth dipped in hot water to remove all superfluous water glass.

◆

A HYDRAULIC TEST FOR THE BOILER.

BY A. C. LAURENCE.

Some time ago my boiler engine was frozen up in a cold snap, and I wished to give my boiler a hydraulic test before steaming up again, to see if it was fit for business. I had no force pump or apparatus of any kind, yet I tested the boiler to the desired pressure, 100 pounds. I have had conversations with engineers since then, and not one of them could tell me how to make such a test without any apparatus, so I believe the idea may be useful for Handy Man's Workshop. I filled the boiler completely with water, leaving no air space whatever, then built a small fire under the boiler, and as the cold water warmed up and expanded, I watched the pressure gage rise until it reached the desired testing pressure, when I opened one of the try cocks, allowing a small quantity of water to escape and relieve the pressure. Having found things O. K., I drained water from the boiler to the proper level and proceeded to get up steam.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TROUSERS-EXPANDER.—J. SARGH, New York, N. Y. The expander holds the trousers expanded at the inner sides of the wearer's limbs to hide the bow-legged formation, the expander being actuated in a very simple manner from the crotch of the trousers when the wearer is in an erect position, and the expander collapsing when the latter is in sitting position.

BANDAGE-SUPPORT.—C. M. COOKE, New York, N. Y. This bandage is in the form of bands or ribbons wound around the leg of a person afflicted with varicose veins and other ailments. The inventor provides a support for holding the bandage of the type mentioned securely in place, to prevent the bandage from slipping on the leg, and thus allow the bandage to properly fulfill its legitimate functions to the fullest advantage.

Electrical Devices.

MEANS FOR CLOSING AN OPEN TELEGRAPH-CIRCUIT AT A DISTANT KEY.—C. B. JEWELL, La Junta, Colo. The main feature here consists in the provision at a terminal office of an extra switch and circuit, and an extra battery of such higher voltage than the ordinary working batteries that when the battery of higher voltage is switched on to the live wire it will force its current through the resistance around any open key and, by working the relay of that key, apprise the forgetful operator at that station that he has left his key open and thus instruct him to close it.

APPARATUS FOR RECEIVING SUBMARINE SIGNALS.—C. H. MUNDY, Metuchen, N. J. The invention belongs to a class that possesses all the advantages of the others, the same consisting of a sound transmitter exposed directly to the sea and accessible from within the ship, and is distinguished from other inventions of this class in that the transmitter proper may be removed and replaced while the ship is afloat without taking water within the ship.

Of Interest to Farmers.

HARVESTING-MACHINE.—W. LIVTSCHAK, St. Petersburg, Russia. It is rendered possible by this inventor to heap or pile the cut crop in a space on the frame between the main wheel and the finger bar to discharge same in definite heaps upon the ground so that free space is left for the path of the draft animals, and the subsequent binding up into sheaves by hand is facilitated.

Of General Interest.

APPARATUS FOR BUILDING CONCRETE AND OTHER LIKE STRUCTURES.—W. C. POLK, Fort Branch, Ind. Means provide for supporting the forms independently of the concrete, whereby the green concrete will not be strained or broken by the weight of the forms or by removing the forms after the concrete has set; also for releasing and resetting the forms for repeated elevations as the building of the walls proceeds, whereby the same forms are continually used, and saving time and labor; and to support the forms that they will be held plumb and level and require no more attention in this respect after the support has once been properly set.

WINDOW.—A. C. GODDARD, New York, N. Y. The window has a swinging or a transom sash arranged to insure a tight joint, to render the window dust and moisture proof when closed. The window frames and sashes can be constructed of sheet metal in a very simple and exceedingly durable manner.

METHOD OF MANUFACTURE OF ROSIN SOAP AND THE LIKE.—A. W. CARMICHAEL, Savannah, Ga. In the present patent the invention is an improved method for dehydrating a saponified solution of rosin commonly called "wet pulpy size," in the production of hard rosin soap, which is more especially used by paper mills in the so-called sizing or waterproof process.

Hardware.

TRIM-FASTENING.—A. C. GODDARD, New York, N. Y. The invention pertains to metal doors, windows, base boards, and like structures, and its object is to provide a trim or molding fastening, more especially designed for securely and quickly fastening trimmings or moldings in place without the use of screws, rivets, or similar fastening devices, and without showing exterior projections, holes, marks, or the like.

GRAVITY-LOCK FOR WINDOWS.—A. C. GODDARD, New York, N. Y. The object of this improvement is to provide a lock arranged to automatically lock in case of fire when the sash is closed by fusing of the chain link connection, to securely hold the window locked and to allow convenient and quick unlocking of the window sash and opening the same.

PLUG FOR REPAIRING HOSE.—A. L. MONAGHAN, Houston, Texas. The object here is to produce a plug which is especially adapted for use in repairing a puncture or perforation in a hose. More particularly the object is to give the plug a form that will facilitate its introduction into the puncture, and which will operate to insure that the plug will remain in position.

Household Utilities.

CLOTHES-HANGER.—J. G. MADLAND, Port Angeles, Wash. A purpose in this case is to provide a clothes reel or rack having revoluble action and which can be dropped down to be loaded or unloaded, and which can be readily carried up and secured in an upright position for drying purposes.

CURTAIN-FIXTURE.—J. E. BOSLER, Olean, N. Y. The invention provides a fixture which provides means for supporting curtain poles and shade rollers. Further, it provides a device for use in holding and supporting curtain poles and shade rollers, and adapted to be adjusted to permit its use in connection with poles and shade rollers of different sizes.

Machines and Mechanical Devices.

REEDING-MACHINE.—O. SCHULER and R. GLASER, Paterson, N. J. The machine is particularly useful in warping or harnessing looms for weaving textile fabrics. An object of the invention is to provide a machine by means of which the warp threads used in textile looms can be easily and expeditiously inserted in the slits of reeds used in connection with these looms.

Designs.

DESIGN FOR A PEN-BOX, DESK-TRAY, AND PAPER-WEIGHT.—C. R. SMEAD, Hastings, Minn. The ornamental design for a pen box, desk tray, and paper weight, comprises an oblong, square cornered, and flat topped article with its lower half having a slightly receding base marked or fluted with a continuous row of ornamental indentations.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 12, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid, apparatus for making sulfuric, A. Gaillard	909,578
Adjustable hanger, Downing & Duley	909,769
Aerial ropeway, C. W. Henry	909,794
Air brake system, H. W. Ley	909,809
Air compressor, variable volume, M. Kurth	909,427
Air heater, A. Mathias	909,632
Air ship, W. Rumble	909,681
Alloy, J. F. Clapp	909,283
Amusement apparatus, E. Woerth	909,500
Amusement slide, W. S. Tothill	909,480
Animal trap, G. C. Biddle	909,526
Annunciator, E. J. Brandt	909,142
Arsenophenol, Ehrlich & Bertheim	909,380
Automobile spring, L. S. Chadwick	909,365
Automobile steering wheel, A. J. Kinnucan	909,807
Automobile wind shield, H. H. White	909,266
Awl, sewing, A. M. Parker	909,817
Axle oiling device, L. Damour	909,370
Bag, J. D. O'Brien	909,815
Baling press, Neumann & Dunham	909,648
Baling press, W. O. Cumming	909,761
Balloon or air ship, A. F. Godefroy	909,397
Barrel trussing machine, Sullivan & Young	909,705
Bath tub and cabinet, combined, C. W. Peterson	909,329
Bath tub waste and overflow connection, J. F. Eichenlaub	909,170
Battery discharge regulator, E. J. Murphy	909,813
Battery plate, G. B. Rinehart	909,673
Battery, secondary, L. H. Flanders	909,572
Beating engine, A. Muirhead	909,642
Bed, spring, W. E. Frank	909,390
Bed spring, J. H. & L. S. Zeiders	909,504
Bedstead mattress or bottom attachment, S. W. Bennett	909,524
Beet harvester, W. Kite	909,424
Beet topper, Giddings & Blevins	909,395
Bell. See Electric alarm bell.	
Belt buckle, H. L. Perryman	909,213
Belt carrier, C. Miller	909,439
Belt coupling, J. C. Cottie	909,555
Bench clamp, I. Solberg	909,469
Billiard marker, etc., H. R. Wildish	909,494
Billiard table, F. Hepton	909,184
Bin, Cameron & Randolph	909,148
Binder or loose sheet holder, temporary, Pink & Petty	909,331
Block signal system, F. B. Corey	909,158
Boat, hydroplane, L. E. Simpson	909,468
Boiler lug, M. M. Hedges	909,592
Boiler scale removing apparatus, A. Schror	909,235
Boiler setting, D. F. Kilgour	909,805
Boiler stand, range, C. H. Foster	909,777
Bolt clipper, H. K. Porter	909,663
Book, instruction, J. D. Thompson	909,477
Boot and shoe insole, G. W. Belonga	909,138
Boring apparatus, deep, W. Schott	909,234
Bottle, non-refillable, S. Gardner	909,780
Bottle washer, Arndt & Marquart	909,736
Bottling machine crown branding attachment, Gilmore & Mulkey	909,396
Box fastener, N. Dahl	909,161
Box strap and bale tie, A. A. Patzlaff	909,658
Brake shoe, G. A. Woodman	909,271
Brake shoe, H. Lewis	909,431
Brake shoe, A. L. Streeter	909,704
Bridle bit, J. Cummings	909,160
Brush, A. H. Wolcott	909,501
Brush, rotary, H. Nielson	909,204
Bucket, H. Troegeler	909,715
Buckle, A. C. Stone	909,251
Buckle and clasp attaching means, H. Gibson	909,782
Burglar alarm, H. Wettstein	909,492
Burglar alarm, C. E. C. Edey	909,851
Butter compound, making, J. E. Garrette	909,781
Butter, making, C. G. Johnson	909,802
Button, E. R. Hoppler	909,598
Cable hanger, C. L. Peirce, Jr.	909,448
Calculating device, S. R. Lamb	909,621
Calendar, W. H. Hall	909,290
Calendar frame and card, W. H. Hall	909,291
Can, C. Ruchti	909,230
Canning operations, machine employed in, G. G. Glass	909,582
Car automatic air and gas valve, W. D. McPherson	909,320
Car brake rigging, railway, W. H. Sauvage	909,232
Car center bearing, L. W. Barber	909,518
Car construction, passenger, F. M. Brinckerhoff	909,844
Car, dumping, S. Ketchum	909,307
Car dumping apparatus, mine, Hubard & Adams	909,303
Car end framing, A. E. Ostrander	909,208
Car fender, J. D. Wright	909,730
Car friction draft rigging, railway, J. F. O'Connor	909,445, 909,446, 909,816
Car, grain, G. R. Dunn	909,565
Car jack, suspension, A. O. Brill	909,535
Car, passenger, Curwen & Smith	909,762
Car replacer, E. Babin	909,516
Car seat, Budd & Conde	909,147
Car step, extension, E. W. Fuhr	909,577
Car, two-way dump, A. E. Ostrander	909,209
Car underframe, W. P. Bettendorf	909,360
Cars to the floor level, automatic device for bringing hydraulic elevator, I. B. Ritter	909,675
Carbureter, W. C. Westaway	909,490
Card holder, illustrated post, E. O. Williams	909,497
Card rack, E. O. Williams	909,498
Carpet sweeper, O. R. Chaplin	909,366
Cart, combination, O. & M. Helgeson	909,297
Casing for light fixture stems, P. J. Handel	909,405
Cash register, H. S. Hallwood	909,786
Casks, device for planing the rims of, L. Drexler	909,164
Caster, J. E. Johnson	909,305
Catamenial bandage, Treber & Simon	909,349
Cattle stanchion, W. B. Crumb	909,760
Cellar spray, detachable, J. F. Oliver	909,654
Cement buildings, waterproofing paint for Portland, T. A. Edison	909,167
Cement, magnesia, C. Ellis	909,171
Cement structures, waterproofing paint for Portland, T. A. Edison	909,169
Chair. See Nursery chair.	
Child's back rest, L. F. Pullman	909,453
Chimney, M. E. Howe	909,412
Chimney pot, T. B. Cullen	909,159
Christmas tree holder, W. A. Mitchell	909,634
Chuck, rivet holding, Sasseman & Dalin	909,231
Cigar box, A. B. Smith	909,699
Cistern cleaner and water purifier, Murray & Kimball	909,314
Clay, etc., machinery for preparing or treating loam, P. Baur	909,133
Clock, E. F. Herschede	909,298
Clock, electric secondary, Jackson & Vizents	909,418
Clock, electric secondary, H. C. Vizents	909,732
Clock, electric self-winding, Jackson & Vizents	909,417
Clock mount, H. J. Keating	909,422
Clock, self-winding, C. W. Wagner	909,485
Clock system, E. E. Yaxley	909,503
Cloth, etc., machine for cutting lengths of, F. W. Denison	909,854
Cloth or other material, machine for trimming and cutting lengths of, F. W. Denison	909,853
Clothes drier, G. N. Galloway	909,579
Clutch mechanism, J. Maitland	909,810
Cock for flushing tanks, ball, W. H. Perkins	909,328
Cock, stop, A. D. Herschler	909,409
Cock, three-way, E. H. Gold	909,583
Coffee pot, China, C. F. Blanke	909,528
Coin operated releasing mechanism, G. P. Brand	909,362
Coin operating mechanism, Symonds & Brann	909,253
Collar dampening and burnishing machine, Currier & Leitschuh	909,557
Color and making same, sulfur, E. S. Chapin	909,153, 909,156
Color and making same, sulfur, E. T. Bundsman	909,277
Comb, sanitary, H. T. Moler	909,635
Composition board, J. Ferla	909,173
Composition for antiseptic and other purposes, H. S. Blackmore	909,527
Composition of matter, J. Laeufer, et al	909,617
Concrete metal reinforce, G. F. Dodge	909,850
Concrete mixer, A. D. Hadsel	909,784
Concrete tie, reinforced, W. Dunson	909,378
Condenser, G. M. Newhall	909,650
Condiment holder, H. J. McWilliams	909,202
Conduit, sectional, W. G. Wight	909,354
Conveyer, J. B. Denitthorne	909,766
Conveyer belt support, E. E. Vrooman	909,833
Cooking utensil cover, C. J. Cooling	909,284
Cooler, S. M. King	909,806
Coop or crate, O. J. La Bauve	909,614, 909,615
Corn gatherer and husker, E. C. Dean	909,560
Corn separator, seed, C. F. Asplund	909,358
Cot, collapsible, C. B. Lamb	909,620
Cotton chopper, P. Harrison	909,294
Cotton cleaner, A. L. Treese	909,714
Counting device, D. L. Roscoe	909,823
Cradle crusher, B. K. Donald	909,562
Crane mechanism, D. Kendall	909,804
Crate or case, shipping, J. M. Porter	909,664
Crown for winding stems of watches, H. Axtell	909,515
Crusher, De Wind & Hughston	909,374
Crutch, adjustable, G. S. Rhodes	909,224
Crutch tip, E. H. Seibert	909,827
Culinary utensil, H. B. Seely	909,238
Cultivator, O. Caron	909,149
Cultivator, W. J. Asbell	909,512
Cup shaped articles, apparatus for making, W. H. Smith	909,342
Cupola attachment, C. J. Langhorst	909,622
Current motor, alternating, M. C. A. Latour	909,193
Currycomb, J. Olsafskie	909,207
Curtain fixture, P. A. Houghtaling	909,186
Cut off, A. L. Rosene	909,680
Cutlery grinder, H. E. Sweet	909,707
Cutter bar, B. F. McElwee	909,646
Cutter head, E. F. Beugler	909,741
Cycle handle, W. C. Mead	909,633
Damper regulator, W. M. Fulton	909,176
Dental implement, C. C. Murray	909,643
Dental stool or the like, W. H. Reynolds	909,223
Die head, automatic, Brown & Sprink	909,748
Dish washing machine, C. W. Jaycox	909,654
Display rack, J. F. Riedy	909,336
Door check, C. P. Dorn	909,563
Door construction, sliding, J. R. Hussey	909,602
Door opener, F. Conner	909,552
Double rake, R. M. Kenney	909,607
Draft equalizer, H. J. Helder, reissue	12,909
Dredging apparatus, J. Carlesimo	909,543
Drying, C. W. Volney	909,261
Drilling engine, rock, J. A. Traylor	909,259
Driving mechanism, sliding friction, A. A. De Loach	909,372
Drum, winding, F. Donaldson	909,768
Dust collector, H. A. Knox	909,425
Dye and making same, anthracene, M. H. Isler	909,800
Dye and making same, sulfur, E. S. Chapin	909,151, 909,152, 909,154, 909,155
Electric alarm bell, N. Kessler	909,192
Electric alarm, thermo, Paul & Stewart	909,818
Electric fuse, L. W. Downes	909,564
Electric machine brush holder, dynamo, M. Walker	909,834
Electric machine, dynamo, B. A. Behrend	909,136
Electric machine, dynamo, M. W. W. Mackie	909,197
Electric machines, means for starting dynamo, W. D. Pomeroy	909,216
Electric signaling, selective, A. H. Nicholson	909,651
Electric trap for rats, etc., J. T. Norris	909,814
Electrical driving mechanism, G. C. Marx	909,631
Electrical impulse transmitting device, J. Erickson	909,382, 909,383
Electrode or pencil for arc lights, I. Ladoff	909,428
Electrotype plates, bending, B. F. Upham	909,832
Elevator, Sherren & Mason	909,695
Elevator safety device, C. Paradis	909,322
Elevators and other movable objects and bodies, appliance for, A. Lungen	909,433
Embroidering machine fabric roller, A. Saurer	909,826
Engine. See Beating engine.	
Engine admission valve, gas, G. B. Petsche	909,214
Engine bed plate, beater, R. A. North	909,653
Engine starting apparatus, explosive, L. M. Booth	909,140
Engine valve gear, C. F. Prescott	909,665
Engine valve gear, steam, A. Hossfeld	909,302
Ether, santalol, J. Callsen	909,541
Excavator, W. S. Smith	909,700
Exchange switching device, party line, W. Hagstrom	909,403
Extension bolt, C. T. Schwing	909,462
Eyeglass case, A. W. Farrington	909,386
Fabric, N. L. Duryea	909,379
Fare register, J. Lindhart	909,625
Feed mill, R. S. Tomkinson	909,348
Feeding device for machine tools, etc., C. A. Hirth	909,300
Fibers and fabrics, waterproofing, T. A. Edison	909,168
Fibers, treating vegetable textile, A. E. M. Rousseau	909,457
Fibrous material, securing together surfaces of, J. R. Harbeck	909,590
Fifth wheel, R. G. & L. Cator	909,755
File case or cabinet, E. G. Minder	909,440
Filing case, C. P. Zoerb	909,734
Film roll holder, adjustable, W. J. Bresnan	909,534
Firearm with cylindrical breech, semi-automatic, B. Goebel	909,398
Firearms, breech mechanism for self-loading, L. Schmeisser	909,233
Fish hook holder, snelled, C. F. West	909,722
Filer, W. Knowles	909,426
Floor scraping machine, G. S. Newman	909,652
Floor scraper, J. L. Hearing	909,406
Flooring clamp, A. A. Hendrickson	909,408
Flower pot, E. Bade	909,843
Flush tank, J. O. Brousseau	909,537
Flushing tank, H. S. Hawks	909,789
Folding box or crate, H. L. Guilline	909,586
Fruit, apparatus for use in the treatment of, J. C. L. Campbell	909,754
Fruit cutter, A. J. Brunson	909,145
Fruit sorter, A. D. Huntley	909,413
Fruit, treating, J. C. L. Campbell	909,542
Fruits or vegetables, preserving, A. Huch	909,600
Fuel, artificial, J. W. Leadbeater	909,626
Furnace, G. Prescott	909,218
Furnace, A. Wardzinski	909,488
Furnace, W. T. Dodge	909,767
Furnace, Jackson & Aiken	909,801
Furniture, folding, W. Rabich	909,820
Furniture, hollow sheet metal, F. B. Burns	909,540
Furniture joint for wooden structures, A. N. Webb	909,720
Furniture structure lock clamp, knockdown, W. C. Dolcater	909,561
Fuse and fuse block, portable, G. A. Drucker	909,165
Game apparatus, J. Baust	909,520
Game apparatus, D. H. Talbert	909,708
Game apparatus, W. L. Fross	909,779
Gas burner, A. F. Thompson	909,711
Gas burner, safety, J. H. Ahlgren	909,508
Gas generator, acetylene, W. E. Shreffler	909,698
Gas heater automatic cut off, H. A. Koenig	909,308
Gas meter connecting device, Gray & Stevens	909,179
Gas producer, C. L. Straub	909,345
Gas producer, P. G. Schmidt	909,690
Gate, I. Lester	909,194
Gear tooth chamfering apparatus, R. B. Weaver	909,719
Gears, etc., upon shafts, machine for removing from and replacing, C. Remelius	909,671
Glassware, making machine footed, J. I. Arbogast	909,842
Grain drill, A. Bellerive	909,137
Graining compound, F. M. Clapp	909,847
Grate, D. W. Cherry	909,756
Grinder, H. G. McCulloch	909,316
Guide for hemming, B. & G. Branower	909,533
Gun, automatic, Dawson & Buckham	909,849
Gunpowder, smokeless, C. P. H. Claessen	909,546
Hand bag, A. Staeger	909,248
Handle. See Cycle handle.	
Hank dyeing machine, J. H. Ashwell	909,513
Hay carrier, F. S. Polley	909,661
Hay sling lock, A. P. Boyer	909,141
Heating surface, hot air, D. S. Richardson	909,672
Heating system, vapor, J. D. Arnold	909,737
Hinge, detachable, J. F. Melton	909,436
Hog ring, R. Roethlisberger	909,229
Hook and eye, W. M. Corthell	909,554
Horse and cattle water bowl, automatic, P. A. Cheevers	909,282
Horse detacher, M. S. January	909,420
Horseshoe pad, J. Dillon	909,287
Hose coupling, J. J. Antic	909,131
Hose coupling, B. Morgan	909,200
Hose supporter, H. W. Richardson	909,824
Hydrocarbon burner, P. M. Keller	909,180
Hydrocarbon motor, Winkley & Hart	909,728
Hydrogen, composition of matter for generating, G. F. Brindley	909,536
Ice cream mold, T. Cohn	909,550
Ingot, etc., casting apparatus, W. J. Evans	909,570
Ingots, solidifying, E. P. Culnat	909,556
Inkstand, W. H. Wetmore	909,491
Insulated rail joint, E. F. Schermerhorn	909,458
Insulators, screw press to form, Hemingray & Hawk	909,595
Internal combustion engine, F. W. Brady	909,531
Internal combustion engine, C. R. Daellenbach	909,558
Jack, J. W. Carlson	909,364
Ketone sulfoxylate and making same, A. Stock	909,703
Knife handle polishing machine, W. J. Carney	909,544
Knitting machine thread controlled stop motion, circular, N. H. Williams	909,727
Knotting mechanism, L. B. Wygant	909,272
Ladder, H. A. Myers	909,315
Ladder, step, Reed & Spooner	909,669
Ladder, step, J. B. Robertson	909,825
Ladle crane mechanism, D. Kendall	909,606
Ladle, swinging, W. R. Palmer	909,655
Lamp, A. W. Hall	909,785
Lamp, incandescent, M. M. Merritt	909,438, 909,812
Lamp prism, electric, J. C. Zubli	909,507
Lamp receptacle, electric, Patterson & Farrell	909,326
Lamp, safety, N. B. Ippolito	909,415, 909,416
Lamp, therapeutic, E. W. Locke	909,627
Lamps, exhausting, M. M. Merritt	909,811
Lap joint and nut lock, continuous, Gash & McDavitt	909,580
Last, A. G. Fitz	909,387, 909,388
Last support, A. G. Fitz	909,389
Lath holder, J. F. & H. L. Presba	909,217
Lath machine, Bergren & Moan	909,139
Leather, enameling, B. B. Goldsmith	909,288
Leather splitting machine, A. A. Chilson	909,157
Leaves, swinging display, A. M. Parks	909,210
Leg guard for athletes, Pierce & Nickerson	909,215
Letter tying device, B. P. Greenwood	909,390
Letters and other characters, apparatus for manufacturing, T. J. Wallace	909,487
Leveling instrument, A. Blair	909,529
Light distributing device, Pearson & Pierce	909,447
Light sensitive layer carriers, device for exposing, J. Schmuck	909,459
Liquid controller, Shields & Cox	909,340

Liquid evaporating apparatus, J. L. Schrade	909,460
Liquid level apparatus, differential, E. P. Noyes	909,206
Liquid supply, means for automatically controlling, J. T. Wilmore	909,355
Loading and unloading apparatus, J. W. Reynolds	909,222
Location indicator, J. Hofmann	909,798
Lock indicator, F. E. Smith	909,829
Locking device, M. Williams	909,726
Logging device, C. H. Starbird	909,250
Loom, Rhoades & Stimpson	909,821
Loom let off motion, H. Herzberg	909,596
Loom picker, O. Poitras	909,333
Loom shuttle, W. F. Draper	909,377
Loom shuttle, Draper & Northrop	909,771
Loom warp stop motion, A. E. Rhoades	909,822
Lubricator, L. T. Dery	909,162
Mail bag catcher, J. S. Peek	909,659
Mail bag catcher and deliverer, J. H. Knight	909,611
Mail bag delivering and receiving apparatus, C. Dellis	909,371
Mailing package, A. S. Pierson	909,330
Mangle, S. Moe	909,312
Manure and alkali salts, manufacture of, A. Vasseux	909,350
Manure pulverizer and loader, J. N. Frost	909,576
Massage apparatus, vibratory, E. N. Sipperley	909,828
Massaging device, M. Fisch	909,571
Match box, E. L. Hembree	909,407
Match box and cigar cutter, combined, H. L. Farrow	909,852
Match safe and cigar cutter, combined, J. N. Mitchell	909,441
Mattress, wire, G. B. Smith	909,244
Measuring apparatus, F. James	909,188
Measuring line, G. H. Prier	909,668
Measuring stand, revolving, C. E. Thies	909,258
Meat, preserving, R. Emmerich	909,172
Metal harness, W. A. Kuhlman	909,612
Metal pipe, producing, G. D. Dorsey	909,376
Metal plates, machine for forming bars or rounds from, S. McCloud	909,644
Metal sheet prepared for punching, J. R. Harbeck	909,589
Metal sheet piling, M. W. Cluxton	909,549
Metal sheet piling (junction unit), M. W. Cluxton	909,548
Metals, coating with, C. H. Zieme	909,274
Micrometer, E. J. Lees	909,623
Micrometer caliper square, F. S. Buckminster	909,538
Milk separating and butter churning process, G. A. Davidson	909,763
Milking machine, C. H. Seymore	909,239
Mill. See Feed mill.	
Mixing and straining machine, W. S. Kern	909,306
Monkey wrench, folding, J. P. Nikonow	909,205
Mop head, F. W. Pendergast	909,449
Mop wringer, W. Moffat	909,442
Motor for portable grain dumps, hydraulic, J. E. Camp	909,278
Motor for wagon dumps, hydraulic, J. E. Camp	909,279, 909,280
Motors, apparatus for the magnetic ignition in explosion, G. A. Unterberg	909,483
Motors, governing device for two stroke cycle internal combustion, G. W. Thexton	909,256
Music leaf turner, J. A. Friedrichs	909,391
Music leaf turner, A. T. Ziegler	909,505
Music rack, Watkins & Kempf	909,489
Muzzle, calf, C. H. Patterson	909,212
Napkin and supporter, E. C. Rink	909,674
Nursery chair, H. H. Collings	909,758
Nut, lock, E. B. Wiles	909,495
Nut, lock, W. F. Harris	909,788
Nut lock, J. J. Moran	909,637
Nut lock, A. Swanson	909,706
Oil burner, crude, J. W. Parks	909,323
Oil can, F. P. Brennan	909,747
Optical illusion device, F. C. Perkins	909,450
Ore concentrator driving mechanism, E. Deister	909,765
Ore grinding machine, G. A. Denny	909,286
Ore treating machine, J. W. R. Laxton	909,429
Ores and tailings, amalgamator and concentrator for, J. R. Harrison	909,293
Ores, obtaining nickel from silicious, E. F. Price	909,666, 909,667
Ores, reducing, J. Herman	909,795
Ozone generating apparatus, W. Kolle	909,309
Packer, bottom hole, C. M. Heeter	909,593
Packing box, M. H. Longfellow	909,628
Packing, fluid pressure, Parsons & Turnbull	909,324
Paper folding machine, J. H. Adams	909,841
Paper punch, A. M. Barrett	909,739
Paper roll carrier, guide, and cutter, C. R. Hotchkiss	909,599
Paper trimmer, C. T. Ridgley	909,227
Papers, apparatus for collecting, folding, and wrapping, W. A. Tompkins	909,712
Pea separator, A. L. Hamacek	909,587
Pen, fountain, F. E. Waterman	909,262
Pen, writing, W. H. Schweizer	909,236
Phonograph, magazine, C. Reinhardt	909,455
Phonograph record, H. Schroder	909,461
Phonograph record disks, album for, B. Hirsch	909,410
Piano pedal mounting, H. Sandner	909,683
Piano valve mechanism, autopneumatic, J. Skubis	909,242
Picture lifter, E. M. Wollam	909,729
Picture machine, moving, A. F. Hamacek	909,404
Pin holding and dispensing device, L. F. Woodhead	909,270
Pipe coupling, J. M. St. John	909,830
Pipe ferrule, J. R. Williams	909,725
Pipe turning apparatus, E. E. Williams	909,724
Pipes, device for removing burs from, C. A. Hart	909,182
Pistol, toy, H. D. Gardy	909,393
Placer mining machine, A. L. Corson	909,553
Platen press automatic register gage, H. E. Staniford	909,249
Plow, T. D. Sims	909,241
Plow, C. B. Clark	909,848
Plow, snow, A. Horn	909,301
Plumb bob and chalk-line holder, W. N. Cavileer	909,846
Porcelain facing locking device, Poole & Heffelfinger	909,662
Porch swing, G. P. & R. N. McEntire	909,317
Potato digger, W. H. Bearinger	909,521
Potato gathering machine, J. Dolman	909,375
Potato picking machine, S. Geigel	909,581
Potential starter attachment, H. W. Cheney	909,367
Powdered materials, delivery receptacle for, T. S. Patterson	909,657
Printing frame, photographic, J. C. Morgan	909,639
Printing machinery, J. A. J. Hayes	909,591
Printing plates by means of electrolytic etching, preparing, H. Strecker-Aufermann	909,831
Printing press, R. Miehle	909,199
Printing press, B. F. Upham	909,260
Printing press, F. W. Forshall	909,776
Printing press ink distributer, automatic, W. B. Sheffield	909,339
Propeller, E. D. Spear	909,246
Protractor, C. O. Schellenbach	909,686
Pulley, sheet metal, J. E. Zimmermann	909,506
Pulp articles, apparatus for making, M. L. Keyes, reissue	12,911
Pulverizing machine, H. Besser	909,275
Pump, C. Behn	909,135
Pump, R. C. Bingham	909,276
Pump, G. A. Rockola	909,676
Pump, compound, J. Desmond	909,163
Pump, hydraulic, J. W. Nelson	909,647
Pump, lubricating, F. Stahll	909,471
Pump, vacuum, C. L. Heisler	909,183
Punch, H. Denburger	909,285
Quilting frame, L. A. Ashby	909,357
Rack. See Card rack.	
Rail rack and traction locomotive, N. D. Levin	909,430
Rail anchor, J. M. Scott	909,692
Rail anchorage, third, W. B. Potter	909,335
Rail chair, E. P. Batchelder	909,519
Rail joint, H. G. Gillmor	909,177
Rail joint, A. Swenson	909,346
Railway car bolster, J. M. Hansen	909,588
Railway controlling and signaling system, electric, H. E. McDonnell	909,201
Railway cross-tie, J. A. Atwood	909,359
Railway crossing, A. E. Kaltschmidt	909,189
Railway platform guard, H. C. Heffner	909,791
Railway rail joint, Drake & Pierce	909,770
Railway rolling stock against injury, means for protecting the operatives of, Lahey & Williams	909,618
Railway smoke and dust arrester, E. V. Estill	909,384
Railway spike, T. J. Akers	909,509
Railway spikes, etc., means for fastening in position, G. Lakhovsky	909,619
Railway switch, E. Rush	909,682
Railway switch structure, H. Theis	909,710
Railway tariffs, circulars, etc., filing means for, Spangle & Parsons	909,245
Railway tie, A. S. Topping	909,713
Railway tie, J. W. Calder	909,752
Railway tie, metallic, J. E. Raby	909,220
Railway tie plate, J. E. Muhlfeld	909,443
Railway tie remover, J. H. Rice	909,225
Rake cleaning attachment, horse, E. Weidlein	909,721
Reamer, E. Haber	909,401
Reamer, C. H. Malmedie	909,434
Recording annunciator, W. B. Woodruff	909,502
Reel, H. M. Danker	909,559
Refrigerator or cooler, C. Hinrichs	909,597
Relay, Buchanan & Wiegand	909,146
Revolving and sliding chair, Butcher & Perrin	909,751
Ribbon holder, J. W. Beck	909,522
Road construction, Williamson & Brennan	909,499
Road scraper, riding wheel, Robinson & Saffer	909,228
Roads, combined mixer and sprinkler for making, B. N. Beard	909,134
Rock for refractory material, reducing, Walker & Croft	909,835
Rod, stem, and shaft compound stuffing-box, O. O. Thwing	909,479
Roll holder, E. O. Bulman	909,750
Rope clamp, N. S. Wheeler	909,352
Rotary engine, F. M. Whitman	909,493
Rotary engine, H. C. Schaefer	909,685
Rotary kiln, M. G. Semper	909,464
Rotary motor, G. W. Flora	909,774
Routing machine cutter-guiding templet, C. W. Montgomery	909,636
Rubber heel, R. T. Elwell	909,567
Rule joint, T. Prentice	909,819
Saddle, A. P. Fachiri	909,385
Safe, O. W. Bedell	909,523
Safe, S. A. Ely	909,568
Safe door, Wilkinson & Mummert	909,496
Sash fastening, window, P. H. McGrath	909,318
Sash for hotbeds, etc., W. S. Bodley	909,361
Sash lock, automatic safety, T. J. Gibson	909,783
Sash lock, duplex, W. Lipps	909,432
Sash operating mechanism, W. Sefton	909,463
Sash, reversible window, C. M. Smith	909,243
Saw, automatic wood, T. P. Pye	909,454
Saw, butcher's, T. A. Tubbs	909,716
Saw swage attachment, J. P. Hedstrom	909,295
Scale bar, tabulating, M. C. Mosher	909,313
Scale, computing, J. S. Bradley	909,743, 909,745
Scale, platform computing, J. S. Bradley	909,744, 909,746
Scale, price, G. Walker	909,486
Screen, H. J. Sharp	909,240
Screw-driver, S. H. Wiesedeppe	909,723
Seal, E. J. Brooks	909,363
Seals on papers, device for impressing, A. L. Webster	909,836
Sealing band, J. W. Ripper	909,337
Seed planter, Grisell & Haley	909,289
Seeding and drilling machine, T. J. Thorp	909,478
Settling tank, oil, O. Zobler	909,733
Sewer pipe, C. M. Stratton	909,344
Sewing machine looper thread pull-off, R. G. Woodward	909,839
Sewing machine trimming mechanism, R. G. Woodward	909,840
Sewing mechanism and pull-off device therefor, overseaming, R. G. Woodward	909,838
Shade and curtain bracket, combined window, G. W. White	909,353
Shade and curtain holder device, window, T. S. Plikerd	909,452
Shade roller adjustable support, W. J. Winas	909,269
Shade roller bracket, C. Lindquest	909,195
Sharpening machine, A. M. McLeran	909,319
Shearing device, automatic, M. Szax	909,476
Shears, C. W. Sprague	909,470
Shears and cigar-tip cutter, combined, A. L. Tolman	909,347
Sheet metal working machine, L. J. Shifley	909,341
Shoe rack tag holder, F. A. Putnam	909,219
Shoe sole, C. K. Sharood	909,338
Shore protector, J. C. Keller	909,423
Shutter lock, portable, J. L. Benton	909,525
Shuttle mechanism, A. C. Roebuck	909,677
Sieve, adjustable, C. Closz	909,757
Sifter, flour, I. M. Newell	909,649
Signal apparatus, C. J. Coleman	909,551
Signature feeding and assembling machine, D. G. Smyth	909,701
Skylight and ventilator, combined, B. G. Steele	909,472
Sled runner, C. M. Ford	909,775
Sleigh or go-cart, convertible, H. E. [illegible]	909,211
Sound reproducing instrument, W. H. McCurdy	909,645
Spark arrester, J. E. Knight	909,610
Spark arrester, F. J. Pierce	909,660
Spark coil, J. O. Heinze, Jr.	909,594
Sparking igniter, L. H. Wattles	909,264
Speed recorder, A. Turner	909,482
Spindle, F. Seymour	909,465
Spinning, doubling, and twisting machine, F. Seymour	909,466
Spool unwinder, E. J. Rich	909,456
Spoon clamp, engraver's, F. W. Crocker	909,759
Spring. See Automobile spring.	
Sprinkler alarm and indicator, automatic, F. W. Milliken	909,311
Square, L. V. Shepherd	909,694
Stacker, rotary, R. T. Dye	909,166
Stamp gage device, time, H. C. Vizents	909,731
Stand, J. A. Clark	909,547
Stays, piecing, B. V. Kershner	909,608
Steam cooker for oil bearing meal, etc., M. W. Faherty	909,773
Steam cooker for oil bearing meal, etc., A. W. French	909,778
Stipple member, F. C. Newell	909,444
Stirrup, T. E. Alter	909,735
Stone, facing artificial, J. C. Henderson	909,792
Stone tooling machine, J. B. Heighington	909,296
Stove and fireplace backboard, gas, H. Rosamyer	909,678
Stove and hot-water heater, gas, J. L. Levering	909,624
Stove oil burner attachment, J. M. Barnes	909,132
Stud pin and seat therefor, W. H. Fothergill	909,575
Stuffing-box, J. W. Walters	909,263
Switch, R. W. Borchert	909,742
Switch frog, J. W. Walls	909,351
Table, W. Hanley	909,787
Tally box, E. K. Hood	909,185
Tank automatic refilling apparatus, pressure, T. P. & T. B. Ford	909,574
Tank operating device, flush, B. O. Tilden, reissue	12,910
Tanning extracts, manufacture of, D. Stewart	909,343
Tap, adjustable collapsing, Brown & Sprink	909,749
Tapping machine, C. A. Mercier	909,437
Tea and coffee percolator, Gordon & Mumma	909,178
Telautograph, C. F. Jenkins	909,421
Telegraph relay and sounder, combined, A. J. Meyer	909,198
Telegraph system, quadruplex, C. J. App	909,511
Telegraphone apparatus, E. A. Tytten	909,414
Telephone directory index attachment, E. F. Morton	909,641
Telephone transmitter, J. B. Edwards	909,566
Telephone transmitter, S. A. & R. L. Stienbarger	909,702
Telephone transmitter attaachment, J. S. Wincrantz	909,356
Terminal connector, W. C. Tregoning	909,481
Thread-finishing machine, silk, E. Pohl	909,332
Threads, producing cellulose, E. Thiele	909,257
Tie plate and guard rail brace, combined, Reinoehl & Weaver	909,670
Tile, A. S. Janin	909,663
Tire, E. T. Greenfield	909,180
Tire metallic thread, pneumatic, M. C. St. John	909,475
Tires, making, E. T. Greenfield	909,181
Tobacco press, A. I. Fjelsted	909,174
Tobacco stick holder, J. H. Thackston	909,255
Toilet set, pocket, A. S. Yorks	909,273
Tongue shaping machine, C. W. Borg	909,530
Tool coupling, pneumatic, A. Hebert	909,790
Tool for securing the covers in paint tins, etc., Taylor & Muller	909,254
Tool, glass severing, L. J. Pierce	909,451
Tool lubricator, pneumatic, J. C. Beckfield	909,740
Tool, molder's, J. H. Casson	909,150
Tooth crowns, etc., molding, Shimura & Minagawa	909,696
Torpedo, E. O'Toole	909,321
Towel rack, H. B. Rose	909,679
Toy or ornament, E. A. Shaw	909,467
Toy, pyrotechnic, A. & C. Weinrich	909,265
Track fastening and tie, D. A. Brubaker	909,144
Tracker bar, G. P. Brand	909,532
Train order holding and delivering device, Greene & Burdett	909,585
Trap, P. S. Hicks	909,797
Trolley, E. H. Green	909,584
Trolley pole fastening, O. L. Spry	909,247
Trolley wire hanger, H. Schutte	909,691
Trolley wire support or hanger, C. G. Ette	909,569
Truck dynamo drive, car, E. T. Ford	909,573
Trunk border piece, traveling, B. Marstaller	909,630
Trunks, etc., automatic tray lifter for, C. A. Wells	909,837
Truss, Mayer & Strahlmann	909,435
Tube mill, H. W. Hardinge	909,292
Tubular structures, reinforcing, Hilborn & Roehl	909,299
Turbine, Kelly & Tschinkel	909,191
Turbine, Culver & Heckard	909,369
Turbine, fluid pressure, O. Richter	909,226
Turbine, impulse, M. J. Scanlon	909,684
Typewriter cabinet, W. Hetterschied	909,796
Typewriter carriage return mechanism, E. A. Burlingame	909,539
Typewriting machine, M. W. Pool	909,334
Typewriting machine, H. H. Steele	909,473
Typewriting machine, C. S. Labofish	909,616
Typewriting machine indicator attachment, A. H. Partridge	909,656
Valise, S. P. S. Patch	909,325
Valve, E. V. Anderson	909,510
Valve, A. W. Cash	909,545
Valve-controlling mechanism, signal, Turner & Lewis	909,717
Valve, flushing, T. R. Jenkins, Jr.	909,605
Valve for stand-pipes, balance, Short & Cooley	909,697
Valve for tire pumps, pressure controlling, J. Desmond	909,373
Valve mechanism, Ilmer & Kunze	909,187, 909,304
Valve operating device, flushing, C. H. Bacon	909,517
Vase forming apparatus, J. G. Moritz	909,640
Vault core-releasing device, burial, J. L. Gaskill	909,394
Vehicle, A. Hage	909,402
Vehicle body holder, W. C. Burris	909,845
Vehicle cushion, P. F. Guthrie	909,400
Vehicle thill, adjustable, G. H. Mathews	909,310
Vehicle shaft support, J. R. Scruggs	909,693
Vehicle storm front, G. W. Scott	909,237
Vehicle wheel tire, A. M. Janofsky	909,419
Vehicle wrench, C. J. Atkins	909,514
Vending machine, J. Schmidt	909,687 to 909,689
Ventilator, J. W. Ellis	909,381
Ventilator, R. F. Hunter	909,601
Ventilator, F. Emmenegger	909,772
Vessel, double walled, M. Neuner	909,203
Vessel, double walled, C. S. Reed	909,221
Victuals, apparatus for transporting cold and hot, Straub & Steinhilber	909,252
Violin tuning peg, Calvert & Frisbie	909,753
Wagon dump, J. E. Camp	909,281
Wall supporting device for trenches, W. Z. Laughterback	909,808
Washer. See Bottle washer.	
Washing machine, R. E. L. Johnston	909,803
Washtub and sink, combined, T. N. Furlong	909,392
Water hydrant, Payne & Ross	909,327
Water-of-condensation-cleaning apparatus, B. E. Van Auken	909,484
Water waste preventer, F. J. Morgan	909,638
Well packer, W. H. & L. P. Kesselman	909,609
Wheel chair, C. L. Hockney	909,411
Wheel tire rim, J. A. Connor	909,368
Whip holder, H. G. Weatherill	909,718
Whip socket, W. Luther	909,629
Wind wheel, J. Dawes	909,764
Windmill attachment, I. J. Folly	909,175
Window cleaner and wiper, combined, C. E. Hening	909,793
Window fastener, show, J. Windle	909,267, 909,268
Wire covering machine, W. H. Taylor	909,709
Wire crimping machine, J. S. Barnes	909,738
Wire tension device, planter check, W. J. Lundgren	909,196
Work rest, W. J. Brennan	909,143
Wrench, W. J. Stenger	909,474
Wrench, W. O. Kyle	909,613
Wrench, J. W. Hurley	909,799

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Boots and shoes, leather, Joseph Strasburger Co.	72,282
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Bread, potato, H. J. Mees	72,229
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Matches, J. A. Hunt	72,249
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Oranges and grape fruit, E. P. Porcher	72,232
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Pharmaceutical preparations, certain, G. F. Smith	72,258
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Shoes, certain, Pontiac Shoe Manufacturing Co.	72,291
Shoes, certain, Slater & Morrill	72,294
Shoes, certain, Stilson Kellogg Shoe Co.	72,295
Soaps, J. W. Wilbur	72,263
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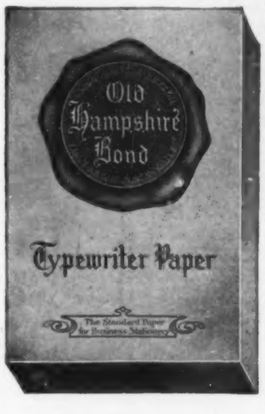

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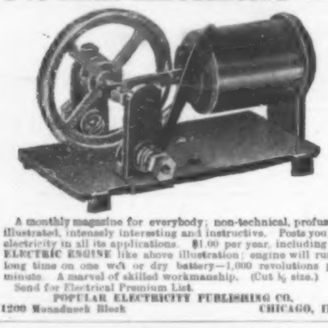

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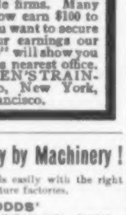

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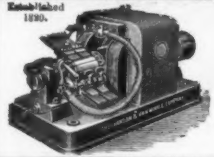

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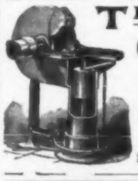

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Scientific American Supplement 1538 gives the proportion of gravel and sand to be used in concrete.

Scientific American Supplements 1567, 1568, 1569, 1570, and 1571 contain an elaborate discussion by Lieut. Henry J. Jones of the various systems of reinforcing concrete, concrete construction, and their applications. These articles constitute a splendid text book on the subject of reinforced concrete. Nothing better has been published.

Scientific American Supplement 997 contains an article by Spencer Newberry in which practical notes on the proper preparation of concrete are given.

Scientific American Supplements 1568 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry.

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1564 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Scientific American Supplement 1573 contains an article by Louis H. Gibson on the principles of success in concrete block manufacture, illustrated.

Scientific American Supplement 1574 discusses steel for reinforced concrete.

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

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